MAR 21 1922

Vol. 15 FEBRUARY, 1922 No. 1

JOURNAL

OF

ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

E. PORTER FELT, *Editor*
W. E. BRITTON, *Associate Editor*
A. F. BURGESS, *Business Manager*

Advisory Committee

L. O. HOWARD H. A. GOSSARD ARTHUR GIBSON
R. W. HARNED C. H. POPENOE R. A. COOLEY

Published by
AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS
GENEVA, N. Y.

Entered March 14, 1921, as second-class matter at the Post-office at Geneva, N. Y., under the Act of Congress of March 3, 1879

CONTENTS

PAGE

American Association of Economic Entomologists
Officers iii
List of Meetings and Past Officers v
List of Members xii
Proceedings of the Thirty-fourth Annual Meeting 1
Part I, Business Proceedings 2
Entomologists' Dinner 23
The Organization Meeting of the Association of Economic Entomologists at Toronto, August, 1889 *L. O. Howard* 25
J. H. Comstock, Remarks 31
Herbert Osborn, Remarks 35
Lawrence Caesar, Remarks 40

Part II, Addresses and Discussions
How We May Increase the Effectiveness of Economic Entomology *G. H. Dean* 44
Economic Entomology in Quebec During the Last Decade *Father Leopold* 52
Cooperation of Agricultural Colleges with High Schools and Rural Schools in Economic Entomology *E. G. Kelly* 54
Presidential Address, Discussion 58
Outlines and Progress of Work being Conducted against the Japanese Beetle, *Popillia japonica* *C. H. Hadley* 62
The Reaction of the Japanese Beetle to Arsenical Spray Deposits *Wm. Moore* 67
Cheaper Arsenicals and Their Use *G. E. Sanders* 71
Some Further Experience with Contact Dusts *T. J. Headlee* 75
Control of Sucking Insects by Dusting *P. J. Parrott* 82
An Account of the Successful Use of the Aeroplane in Dusting Tall Trees Infested with Leaf Eating Caterpillars.[1] *J. S. Houser* and *C. R. Neillie* 85
The Boom Nozzle System and the Traction Duster as Factors in Grape Leaf Hopper Control *D. M. DeLong* 89
Derris as a Promising Insecticide *R. W. Wells, F. C. Bishopp* and *E. W. Laake* 93
The Apple Sucker, *Psylla mali* *W. H. Britain* 98
The False Apple Red-Bug, *Lygidea mendax* in Pennsylvania *S. W. Frost* 102

Report of the Meeting of Cotton States Entomologists 105
Scientific Notes 113
Editorial 115
Current Notes 116
Agriculture 119
Horticultural Inspection 120

---

[1] To be issued for publication elsewhere.

Gen. Work

CONTENTS

PAGE

American Association of Economic Entomologists:

Officers ix

List of Meetings and Past Officers x

List of Members xii

Proceedings of the Thirty-Fourth Annual Meeting, Business Proceedings 1

Apiculture 119

Horticultural Inspection 120, 192, 255, 323, 385, 440
Presidential Address, Discussion 58
Entomologists' Dinner 23

J. H. Comstock, Remarks 31

Herbert Osborn, Remarks 35

Lawrence Caesar, Remarks 40

Pacific Slope Branch, Proceedings of the Seventh Annual Meeting of the American Association of Economic Entomologists 387
Apicultural Notes 119, 189, 258, 326, 383

Book Reviews 249

Cotton States Entomologists 105

Current Notes 116, 185, 251, 319, 377, 435

Editorial 115, 184, 248, 317, 376, 435

Insecticides, Department of 326

New European Bee Disease Threatens Beekeeping in America 177

Notes on Medical Entomology 259, 325, 383

Pacific Slope News 101, 259, 325, 440

Scientific Notes 112, 179, 246, 311, 372, 432

Papers:

BEYER, A. H. Experiments on the Biology and Tipburn Disease of the Bean Leaf Hopper, *Empoasca mali*, with Methods of Control 298

BORODIN, D. N. The Present Status of Entomology and Entomologists in Russia 172

BRITTAIN, W. H. The Apple Sucker 96

BRITTON, W. E. Tobacco Plant Injury by Seed Corn Maggot 275

PARROTT, P. J. Control of Sucking Insects by Dusting 82

PETERSON, ALVAH Further Observations on the Use of Paradichlorobenzene for the Control of the Peach Tree Borer[1] 200

PETTIT, MORLEY Essentials of Apiary Practice and Management 121

PHILLIPS, E. F. The Ability of Queen and Drone Honeybees to Feed Themselves 430

The Effect of Activity on the Length of Life of Honey Bees 368

PIRSCH, G. B. Studies of the Temperature of Individual Insects, with Special Reference to the Honey Bee[1] 134

QUAYLE, H. J. Dusting versus Spraying for the Codling Moth in Walnuts 371

Resistance of Certain Scale Insects in Certain Localities to Hydrocyanic Acid Fumigation 400

RICHARDSON, C. H., and RICHARDSON, E. H. Is the House-fly in its Natural Environment Attracted to Carbon Dioxide 425

RUDOLFS, W. Nicotine Delivery from Dust Carriers 421

RUGGLES, A. G. Horticultural Inspection Section, Address of Chairman 146

SANDERS, G. E. Cheaper Arsenicals and Their Use 71

SASSCER, E. R. Important Insects Collected on Imported Nursery Stock in 1921 158

SASSCER, E. R., and WEIGEL, C. A. Fumigation with Hydrocyanic-acid gas in Greenhouses on a Commercial Basis 200

SCHWING, E. A., and HARTUNG, W. J. Utilization of Systematic Observations on Beet Leafhopper, *Eutettex tenella* Baker, and Curly Leaf of Sugar Beets 365

SEVERIN, H. H. P., and BASINGER, A. J. Facts Concerning Migration of Beet Leafhopper, *Eutettex tenella* Baker, in Sacramento Valley of California 404

Facts Concerning Natural Breeding Area of Beet Leafhopper, *Eutettex tenella* Baker, in San Joaquin Valley of California 411

SLADEN, F. W. L. Memorial Resolution 146

SMITH, L. B. Larval Food Habits of the Japanese Beetle, *Popillia japonica* 307

STRICKLAND, E. H. Poisoned Molasses for the Destruction of Noctuid Moths 214

TREHERNE, R. C. The Onion Maggot in British Columbia under Irrigated Conditions[1] 240

WADLEY, F. M. Control of Strawberry Leaf Roller in the Mississippi Valley 356

[1]Withdrawn for publication elsewhere.

WARREN, D. C. Relation of Moisture to Ingestion of Poison by the Cotton Boll Weevil 345

WEIGEL, C. A., and DOUCETTE, C. F. Further Observations on the Strawberry Root Worm on Roses 204

WELLS, R. W., BISHOPP, F. C., and LAAKE, E. W. Derris as a Promising Insecticide 90

WILSON, H. F. Relation of Climate to Beekeeping Manipulations 143

1	Geo. E. Sanders	10
2	S. W. Frost	11
3	H. E. Hodgkiss	12
4	W. B. Cartwright	13
5	Don B. Whelan	14
6	C. H. Hadley	15
7	T. L. Guyton	16
8	H. L. Dozier	17
9	W. V. Baduf	18

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS,

10 P. A. Glenn
11 E. P. Felt
12 Geo. G. Ainslie
13 P. J. Parrott
14 A. L. Quaintance
15 Herbert Osborn
16 J. G. Sanders
17 Geo. A. Dean
18 A. F. Burgess
19 E. A. Back
20 H. A. Gossard
21 E. G. Kelly
22 Arthur Gibson
23 J. D. Evans
24 Glenn W. Herrick
25 W. E. Britton
26 Mrs. W. E. Britton
27 E. D. Ball
28 Ralph Hopping
29 Annette F. Braun
30 Edith M. Patch
31 Grace M. Griswold
32 Lawson Caesar
33 J. J. Davis
35 C. A. Weigel
36 N. E. McIndoo
37 R. D. Whitmarsh
38 Alvah Peterson
39 H. B. Hungerford
40 S. B. Fracker
41 E. H. Dusham
42 W. H. Larrimer
43 D. M. DeLong
44 J. W. McColloch
45 P. T. Barnes
46 W. J. Nolan
47 T. J. Naudé
48 C. H. Richardson
49 J. T. Potgieter
50 Henry Ness
51 R. W. Harned
52 C. H. Batchelder
53 R. Matheson
54 M. D. Leonard
55 C. L. Metcalf
56
57
58
59
60
61
62
63
64

SOCIATION OF ECONOMIC ENTOMOLOGISTS, Toronto, Ontario, Canada, Dec. 29, 1921.

47 T. J. Naudé
48 C. H. Richardson
49 J. T. Potgieter
50 Henry Ness
51 R. W. Harned
52 C. H. Batchelder
53 R. Matheson
54 M. D. Leonard
55 C. L. Metcalf
56 C. J. Drake
57 M. W. Blackman
58 T. H. Parks
59 E. C. Cotton
60 W. P. Flint
61 J. R. Horton
62 G. M. Bentley
63 W. R. Walton
64 Geo. H. Rea
65 R. L. Webster
66 F. C. Craighead
67 H. L. Fackler
68 H. F. Hudson
69 W. A. Ross
70 Hugh Glasgow
71 E. H. Strickland
72 L. P. Rockwood
73 C. R. Crosby
74 W. L. Chandler
75 W. H. Moore
76 J. R. Watson
77 J. D. Tothill
78 L. Haseman
79 L. S. McLaine
80 C. E. Petch
81 N. F. Howard
82 Father Leopold

Chandler
Moore
Watson
Tothill
eman
McLaine
Petch
Howard
Leopold

83 P. R. Lowry
84 Frank N. Wallace
85 Z. P. Metcalf
86 E. R. Sasscer
87 W. C. O'Kane
88 A. V. Mitchner
89 S. J. Hunter
90 A. G. Ruggles
91 F. C. Bishopp

92 Eugenia McDaniel
93 Seymour Hadwen
94 J. S. Houser
95 H. L. Seamans
96 R. A. Cooley
97 E. M. Walker
98 Norman Criddle
99 M. C. Tanquary
100 C. R. Phipps

101 W. Downes
102 W. E. Biggar
103 C. J. S. Bethune
104 S. A. Forbes
105 J. H. Comstock
106 Mrs. J. H. Comstock
107 L. O. Howard
108 O. A. Johannsen

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

(Organized 1889, Incorporated December 29, 1913)

OFFICERS, 1922

President
J. G. SANDERS, Harrisburg, Pennsylvania

First Vice-President
J. M. SWAINE, Ottawa, Canada

Second Vice-President (Pacific Slope Branch)
A. L. LOVETT, Corvallis, Oregon

Third Vice-President (Horticultural Inspection)
R. W. HARNED, Agricultural College, Mississippi

Fourth Vice-President (Apiculture)
M. C. TANQUARY, College Station, Texas

Secretary
A. F. BURGESS, Melrose Highlands, Massachusetts. Term expires, 1923

PACIFIC SLOPE BRANCH
Secretary
E. O. ESSIG, Berkeley, California

SECTION OF HORTICULTURAL INSPECTION
Secretary
E. R. SASSCER, Washington, District of Columbia

SECTION OF APICULTURE
Secretary
G. M. BENTLEY, Knoxville, Tennessee

STANDING COMMITTEES

Committee on Policy.

GEORGE A. DEAN, Chairman, Manhattan, Kansas. Ex-officio.
J. G. SANDERS, Harrisburg, Pennsylvania Ex-officio
A. F. BURGESS, Melrose Highlands, Massachusetts. Ex-officio.
E. P. FELT, Albany, New York, Ex-officio.
P. J. PARROTT, Geneva, New York. Term expires 1926
WILMON NEWELL, Gainesville, Florida. Term expires 1925.

W. C. O'KANE, Durham, New Hampshire. Term expires 1924.
E. D. BALL, Washington, District of Columbia. Term expires 1923.
HERBERT OSBORN, Columbus, Ohio. Term, expires 1922.

Committee on Nomenclature.
EDITH M. PATCH, Chairman, Orono, Maine.
Z. P. METCALF, West Raleigh, North Carolina.
ARTHUR GIBSON, Ottawa, Canada.

Committee on Membership.
A. G. RUGGLES, Chairman, St. Paul, Minnesota. Term expires 1922.
J. S. HOUSER, Wooster, Ohio. Term expires 1923.
GEORGE G. AINSLIE, Knoxville, Tennessee. Term expires 1924.

Committee on the U. S. National Museum.
J. J. DAVIS, Chairman, LaFayette, Indiana. Term expires 1923.
E. P. FELT, Albany, New York. Term expires 1926.
HERBERT OSBORN, Columbus, Ohio. Term expires 1925.
W. J. HOLLAND, Pittsburgh, Pennsylvania. Term expires 1924.
V. L. KELLOGG, Washington, District of Columbia. Term expires 1922.

Representative to National Research Council.
GEORGE A. DEAN, Manhattan, Kansas.

Councillors for the American Association for the Advancement of Science.
T. J. HEADLEE, New Brunswick, New Jersey.
L. O. HOWARD, Washington, District of Columbia.

Trustees for Crop Protection Institute.
W. E. BRITTON, New Haven, Connecticut. Term expires 1924.
W. C. O'KANE, Durham, New Hampshire. Term expires 1923.
P. J. PARROTT, Geneva, New York. Term expires 1922.

LIST OF MEETINGS AND PAST OFFICERS

First Annual Meeting, Washington, D. C., Nov. 12—14, 1889. President C. V. Riley; First Vice-President, S. A. Forbes; Second Vice-President, A. J. Cook; Secretary, John B. Smith.

Second Annual Meeting, Champaign, Ill., Nov. 11—13, 1890. (The same officers had charge of this meeting.)

Third Annual Meeting, Washington, D. C., Aug. 15—18, 1891. President, James Fletcher; First Vice-President, F. H. Snow; Second Vice-President, Herbert Osborn; Secretary, L. O. Howard.

Fourth Annual Meeting, Rochester, N. Y., Aug. 15—16, 1892. President, J. A. Lintner; First Vice-President, S. A. Forbes; Second Vice-President, J. H. Comstock; Secretary, F. M. Webster.

Fifth Annual Meeting, Madison, Wis., Aug. 14—16, 1893. President, S. A. Forbes; First Vice-President, C. J. S. Bethune; Second Vice-President, John B. Smith; Secretary, H. Garman.

Sixth Annual Meeting, Brooklyn, N. Y., Aug. 14—15, 1894. President, L. O. Howard; First Vice-President, John B. Smith; Second Vice-President, F. L. Harvey; Secretary, C. P. Gillette.

Seventh Annual Meeting, Springfield, Mass., Aug. 27—28, 1895. President, John B. Smith; First Vice-President, C. H. Fernald; Secretary, C. L. Marlatt.

Eighth Annual Meeting, Buffalo, N. Y., Aug. 21—22, 1896. President, C. H. Fernald; First Vice-President, F. M. Webster; Second Vice-President, Herbert Osborn; Secretary, C. L. Marlatt.

Ninth Annual Meeting, Detroit, Mich., Aug. 12—13, 1897. President, F. M. Webster; First Vice-President, Herbert Osborn; Second Vice-President, Lawrence Bruner; Secretary, C. L. Marlatt.

Tenth Annual Meeting, Boston, Mass., Aug. 19—20, 1898. President, Herbert Osborn; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, C. L. Marlatt.

Eleventh Annual Meeting, Columbus, Ohio. Aug. 18—19, 1899. President, C. L. Marlatt; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, A. H. Kirkland.

Twelfth Annual Meeting, New York, N. Y., June 22—23, 1900. President, Lawrence Bruner; First Vice-President, C. P. Gillette; Second Vice-President, E. H. Forbush; Secretary, A. H. Kirkland.

Thirteenth Annual Meeting, Denver, Colo., Aug. 23—24, 1901. President, C. P. Gillette; First Vice-President, A. D. Hopkins; Second Vice-President, E. P. Felt; Secretary, A. L. Quaintance.

Fourteenth Annual Meeting, Pittsburgh, Pa., June 27—28, 1902. President, A. D. Hopkins; First Vice-President, E. P. Felt; Second Vice-President, T. D. A. Cockerell; Secretary, A. L. Quaintance.

Fifteenth Annual Meeting, Washington, D. C., Dec. 26—27, 1902. President, E. P. Felt; First Vice-President, W. H. Ashmead; Second Vice-President, Lawrence Bruner; Secretary, A. L. Quaintance.

Sixteenth Annual Meeting, St. Louis, Mo., Dec. 29—31, 1903. President, M. V. Slingerland; First Vice-President, C. M. Weed; Second Vice-President, Henry Skinner; Secretary, A. F. Burgess.

Seventeenth Annual Meeting, Philadelphia, Pa., Dec. 29—30, 1904. President, A. L. Quaintance; First Vice-President, A. F. Burgess; Second Vice-President, Mary E. Murtfeldt; Secretary, H. E. Summers.

Eighteenth Annual Meeting, New Orleans, La., Jan. 1—4, 1906. President, H. Garman; First Vice-President, E. D. Sanderson; Second Vice-President, F. L. Washburn; Secretary, H. E. Summers.

Nineteenth Annual Meeting, New York, N. Y., Dec. 28—29, 1906. President, A. H. Kirkland; First Vice-President, W. E. Britton; Second Vice-President, H. A. Morgan; Secretary, A. F. Burgess.

Twentieth Annual Meeting, Chicago, Ill., Dec. 27—28, 1907. President, H. A. Morgan; First Vice-President, H. E. Summers; Second Vice-President, W. D. Hunter; Secretary, A. F. Burgess.

Twenty-first Annual Meeting, Baltimore, Md., Dec. 28—29, 1908. President, S. A. Forbes; First Vice-President, W. E. Britton; Second Vice-President, E. D. Ball; Secretary, A. F. Burgess.

Twenty-second Annual Meeting, Boston, Mass., Dec. 28—29, 1909. President, W. E. Britton; First Vice-President, E. D. Ball; Second Vice-President, H. E. Summers; Secretary, A. F. Burgess.

Twenty-third Annual Meeting, Minneapolis, Minn. Dec. 28—29, 1910. President, E. D. Sanderson; First Vice-President, H. T. Fernald; Second Vice-President, P. J. Parrott; Secretary, A. F. Burgess.

Twenty-fourth Annual Meeting, Washington, D. C., Dec. 27—29, 1911. President,

F. L. Washburn; First Vice-President, E. D. Ball; Second Vice-President, R. H. Pettit; Secretary, A. F. Burgess.

Twenty-fifth Annual Meeting, Cleveland, Ohio, Jan. 1—3, 1913. President, W. D. Hunter; First Vice-President, T. J. Headlee; Second Vice-President, R. A. Cooley; Secretary, A. F. Burgess.

Twenty-sixth Annual Meeting, Atlanta, Ga., Dec. 31, 1913—Jan. 2, 1914. President, P. J. Parrott; First Vice-President, E. L. Worsham; Second Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

Twenty-seventh Annual Meeting, Philadelphia, Pa., Dec. 28—31, 1914. President, H. T. Fernald; First Vice-President, Glenn W. Herrick; Second Vice-President, W. E. Britton; Third Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

Special Meeting, Berkeley, Cal., Aug. 9—10, 1915. (Officers same as for Twenty-eight Annual Meeting.)

Twenty-eighth Annual Meeting, Columbus, Ohio, Dec. 27—30, 1915. President, Glenn W. Herrick; First Vice-President, R. A. Cooley; Second Vice-President W. E. Rumsey; Third Vice-President, E. F. Phillips; Secretary, A. F. Burgess.

Twenty-ninth Annual Meeting, New York, N. Y., Dec. 28—30, 1916. President, C. Gordon Hewitt; First Vice-President, G. A. Dean; Second Vice-President, E. D. Ball; Third Vice-President, W. J. Schoene; Fourth Vice-President, T. J. Headlee; Secretary, A. F. Burgress.

Thirtieth Annual Meeting, Pittsburgh, Pa., Dec. 31, 1917—Jan. 2, 1918. President, R. A. Cooley; First Vice-President, W. E. Hinds; Second Vice-President, A. W. Morrill; Third Vice-President, G. M. Bentley; Fourth Vice-President, B. N. Gates; Secretary, A. F. Burgess.

Thirty-first Annual Meeting, Baltimore, Md., Dec. 26—27, 1918. President, E. D. Ball; First Vice-President, W. C. O'Kane; Second Vice-President, G. P. Weldon; Third Vice-President, E. C. Cotton; Fourth Vice-President, Franklin Sherman, Jr.; Secretary, A. F. Burgess.

Thirty-second Annual Meeting, St. Louis, Mo., Dec. 31, 1919—Jan. 2, 1920. President, W. C. O'Kane; First Vice-President, A. G. Ruggles; Second Vice-President, H. J. Quayle; Third Vice-President, E. C. Cotton; Fourth Vice-President, W. E. Britton; Secretary, A. F. Burgess.

Thirty-third Annual Meeting, Chicago, Ill., Dec. 29—31, 1920. President, Wilmon Newell; First Vice-President, H A. Gossard; Second Vice-President, E. M. Ehrhorn; Third Vice-President, J. G. Sanders; Fourth Vice-President, F. B. Paddock; Secretary, A. F. Burgess.

Thirty-fourth Annual Meeting, Toronto, Canada, Dec. 29—31, 1921. President, George A. Dean; First Vice-President, Arthur Gibson; Second Vice-President, E. O. Essig; Third Vice-President, A. G. Ruggles; Fourth Vice-President, H. F. Wilson; Secretary, A. F. Burgess.

LIST OF MEMBERS

ACTIVE MEMBERS

1. Abbott, W. S., U. S. Bureau of Entomology, Vienna, Va.
2. Ackerman, A. J., U. S. Bureau of Entomology, Washington, D. C.
3. Ainslie, C. N., 1836 Lemon St., Sioux City, Iowa.
4. Ainslie, George G., R. R. 9, Knoxville, Tenn.
5. Aldrich, J. M., U. S. National Museum, Washington, D. C.
6. Armitage, H. M., 402 S. Greenleaf Ave., Whittier, Calif.

7. Atwood, George G., Depart. of Agriculture, Albany, N. Y.
8. Back, E. A., U. S. Bureau of Entomology, Washington, D. C.
9. Baker, A. C., U. S. Bureau of Entomology, Washington, D. C.
10. Baker, A. W., Ontario Agricultural College, Guelph, Canada.
11. Baker, C. F., Los Banos, P. I.
12. Ball, E. D., Dept. of Agriculture, Washington, D. C.
13. Banks, C. S., Bureau of Science, Manila, P. I.
14. Barber, E. R., Audubon Park, New Orleans, La.
15. Barber, G. W., 10 Court St., Arlington, Mass.
16. Barber, H. S., U. S. Bureau of Entomology, Washington, D. C.
17. Barber, T. C., Box 639, Brownsville, Texas.
18. Becker, G. G., State Plant Board, Little Rock, Ark.
19. Bentley, G. M., University of Tenessee, Knoxville, Tenn.
20. Berger, E. W., University of Florida, Gainesville, Fla.
21. Bethune, C. J. S., Guelph, Ontario, Canada.
22. Beyer, A. H., Gainesville, Florida.
23. Bilsing, S. W., College Station, Texas.
24. Bishopp, F. C., U. S. Bureau of Entomology, Dallas, Texas.
25. Blackman, M. W., N. Y. State College of Forestry, Syracuse, N. Y.
26. Bourne, A. I., Agricultural Experiment Station, Amherst, Mass.
27. Brittain, W. H., Truro, N. S.
28. Britton, W. E., Agricultural Experiment Station, New Haven, Conn.
29. Brooks, F. E., U. S. Bureau of Entomology, French Creek, W. Va.
30. Brues, C. T., Bussey Institution, Forest Hills, Boston, Mass.
31. Bruner, Lawrence, Agricultural Experiment Station, Lincoln, Neb.
32. Burgess, A. F., U. S. Bureau of Entomology, Melrose Highlands, Mass.
33. Burke, H. E., Forest Insect Lab., Palo Alto, Calif.
34. Burrill, A. C., Agricultural Extension Service, Columbia, Mo.
35. Busck, August, U. S. National Museum, Washington, D. C.
36. Caesar, Lawson, Ontario Agricultural College, Guelph, Canada.
37. Caffrey, D. J., 10 Court St., Arlington, Mass.
38. Cameron, A. E., University of Saskatchewan, Saskatoon, Sask.
39. Campbell, R. E., 200 S. Third St., Alhambra, Calif.
40. Caudell, A. N., U. S. National Museum, Washington, D. C.
41. Chandler, W. L., East Lansing, Mich.
42. Chapman, R. N., Dept. of Animal Biology, University of Minnesota, Minneapolis, Minn.
43. Chase, W. W., State Capitol, Atlanta, Ga.
44. Childs, LeRoy, Hood River, Ore.
45. Chittenden, F. H., U. S. Bureau of Entomology, Washington, D. C.
46. Clausen, C. P., 2301 Hearst Ave., Berkeley, Calif.
47. Cleveland, C. R., Agricultural Experiment Station, Lafayette, Ind.
48. Coad, B. R., U. S. Bureau of Entomology, Tallulah, La.
49. Cockerell, T. D. A., 809 Tenth St., Boulder, Colo.
50. Cole, F. R., R. F. D. Box 177, Redlands, Calif.
51. Collins, C. W., U. S. Bureau of Entomology, Melrose Highlands, Mass.
52. Comstock, J. H., Cornell University, Ithaca, N. Y.
53. Conradi, A. F., Clemson College, S. C.
54. Cook, Mel. T., Agricultural Experiment Station, New Brunswick, N. J.
55. Cooley, R. A., Agricultural Experiment Station, Bozeman, Mont.
56. Cory, E. N., Agricultural Experiment Station, College Park, Md.

57. Cotton, E. C., Department of Agriculture, Columbus, Ohio.
58. Cotton, R. T., Bureau of Entomology, Washington, D. C.
59. Crampton, G. C., Agricultural College, Amherst, Mass.
60. Crawford, D. L., College of Hawaii, Honolulu, H. T.
61. Creel, C. W., University of Nevada, Reno, Nev.
62. Criddle, Norman, Treesbank, Manitoba, Can.
63. Crosby, C. R., Cornell University, Ithaca, N. Y.
64. Crossman, S. S., U. S. Bureau of Entomology, Melrose Highlands, Mass.
65. Davidson, William, Vienna, Va.
66. Davis, I. W., Danielson, Conn.
67. Davis, J. J., Agricultural Experiment Station, LaFayette, Ind.
68. Dean, George A., Agricultural Experiment Station, Manhattan, Kan.
69. DeLong, Dwight M., Bureau of Plant Industry, Harrisburg, Pa.
70. De Ong, E. R., College of Agriculture, Berkeley, Calif.
71. Dietz, H. F., 3225 Boulevard Pl., Indianapolis, Ind.
72. Doane, R. W., Stanford University, Calif.
73. Dusham, E. H., 419 W. College Ave., State College, Pa.
74. Ehrhorn, E. M., Honolulu, H. T.
75. Essig, E. O., University of California, Berkeley, Calif.
76. Ewing, H. E., U. S. National Museum, Washington, D. C.
77. Felt, E. P., State Museum. Albany, N. Y.
78. Fenton, F. A., Station A, Iowa State College, Ames, Iowa.
79. Fernald, H. T., Agricultural College, Amherst, Mass.
80. Ferris, G. F., Stanford University, Calif.
81. Fink, D. E., Riverton, N. J.
82. Flint, W. P., 1306 S. Orchard St., Urbana, Ill.
83. Forbes, S. A., University of Illinois, Urbana, Ill.
84. Ford, A. L., Extension Division, Brookings, S. D.
85. Foster, S. W., 201 Sansome St., San Francisco, Calif.
86. Fox, Henry, Mercer University, Macon, Ga.
87. Fracker, S. B., State Capitol, Madison, Wis.
88. Franklin, H. J., East Wareham, Mass.
89. Freeborn, S. B., University of California, Berkeley, Calif.
90. Frost, S. W., Research Laboratory, Arendtsville, Pa.
91. Fullaway, D. T., Agricultural Experiment Station, Honolulu, H. T.
92. Fulton, B. B., Agricultural College, Corvallis, Ore.
93. Gahan, A. B., Berwyn, Md.
94. Garman, H., Agricultural Experiment Station, Lexington, Ky.
95. Garman, Philip, Agricultural Experiment Station, New Haven, Conn.
96. Gibson, Arthur, Entomological Branch, Ottawa, Canada.
97. Gill, John B., U. S. Entomological Laboratory, Aberdeen, N. C.
98. Gillette, C. P., Agricultural Experiment Station, Fort Collins, Colo.
99. Glasgow, Hugh, Agricultural Experiment Station, Geneva, N. Y.
100. Glenn, P. A., Office of State Entomologist, Urbana, Ill.
101. Goodwin, W. H., Wooster, Ohio.
102. Gossard, H. A., Agricultural Experiment Station, Wooster, Ohio.
103. Graf, J. E., Box 205, Biloxi, Miss.
104. Graham, S. A., Div. of Entomology, University Farm, St. Paul, Minn.
105. Guyton, T. L., Bureau of Plant Industry, Harrisburg, Pa.
106. Hadley, Charles H., Jr., Entomological Laboratory, Riverton, N. J.
107. Hagan, H. R., University of Utah, Salt Lake City, Utah.
108. Hall, M. C., Division of Zoology, Bureau Animal Industry, Washington, D. C.

109. Harned, R. W., Agricultural College, Miss.
110. Hartzell, Albert, Ames, Iowa.
111. Hartzell, F. Z., Agricultural Experiment Station, Fredonia, N. Y.
112. Haseman, Leonard, Agricultural Experiment Station, Columbia, Mo.
113. Hawley, I. M., Agricultural College, Logan, Utah.
114. Hayes, W. P., Agricultural Experiment Station, Manhattan, Kan.
115. Headlee, T. J., Agricultural Experiment Station, New Brunswick, N. J.
116. Herbert, F. B., Los Gatos, Calif.
117. Herms, W. B., University of California, Berkeley, Calif.
118. Herrick, Glenn W., Cornell University, Ithaca, N. Y.
119. High, M. M., U. S. Bureau of Entomology, Kingsville, Tex.
120. Hinds, W. E., Agricultural Experiment Station, Auburn, Ala.
121. Hine, J. S., Ohio State University, Columbus, Ohio.
122. Hodgkiss, H. E., Botany Building, State College, Pa.
123. Holland, W. J., Carnegie Museum, Pittsburgh, Pa.
124. Holloway, T. E., U. S. Bureau of Entomology, Audubon Park, La.
125. Hooker, W. A., States Relation Service, Washington, D. C.
126. Hopkins, A. D. U. S. Bureau of Entomology, Washington, D. C.
127. Horton, J. R., 126 S. Minneapolis Ave., Wichita, Kan.
128. Houghton, C. O., Agricultural Experiment Station, Newark, Del.
129. Houser, J. S., Agricultural Experiment Station, Wooster, Ohio.
130. Howard, C. W., Canton Christian College, Canton, China.
131. Howard, L. O., U. S. Bureau of Entomology, Washington, D. C.
132. Howard, Neale F., 1519 12th Ave., South, Birmingham, Ala.
133. Hungerford, H. B. University of Kansas, Lawrence, Kan.
134. Hunter, S. J., University of Kansas, Lawrence, Kan.
135. Hunter, W. D., U. S. Bureau of Entomology, Washington, D. C.
136. Hyslop, J. A., U. S. Bureau of Entomology, Washington, D. C.
137. Illingworth, J. F., Gordonvale, near Cairns, North Queensland.
138. Isely, Dwight, U. S. Bureau of Entomology, Washington, D. C.
139. Johannsen, O. A., Cornell University, Ithaca, N. Y.
140. Johnson, S. A., Agricultural Experiment Station, Fort Collins, Colo.
141. Jones, C. R., Agricultural College, Fort Collins, Colo.
142. Jones, D. W., U. S. Bureau of Entomology, Melrose Highlands, Mass.
143. Jones, P. R., Porterville, Calif.
144. Jones, T. H., Agricultural Experiment Station, Baton Rouge, La.
145. Kellogg, V. L., National Research Council, 1201 16th St., Washington, D. C.
146. Kelly, E. G., Agricultural College, Manhattan, Kan.
147. Kennedy, C. H., Ohio State University, Columbus, Ohio.
148. Kincaid, Trevor, University of Washington, Seattle, Wash.
149. King, J. L., 3233 Carnegie Ave., Cleveland, Ohio.
150. King, W. V., Mound, La.
151. Kisliuk, Max, 134 S. 2d St., Philadelphia, Pa.
152. Knight, H. H., University Farm, St. Paul, Minn.
153. Kotinsky, J., 519 Canal St., New Orleans, La.
154. Lamson, G. H., Jr., Agricultural College, Storrs, Conn.
165. Larrimer, W. H., Box 95, West LaFayette, Ind.
156. Larson, A. O., 200 S. 3d St., Alhambra, Calif.
157. Lathrop, F. H., Agricultural College, Corvallis, Ore.
158. Leiby, R. W., Department of Agriculture, Raleigh, N. C.
159. Leonard, M. D., Bowker Insecticide Co., 49 Chambers St., New York, N. Y.

160. List, G. M., Agricultural College, Fort Collins, Colo.
161. Lochhead, William, Macdonald College, Canada.
162. Loftin, U. C., Tlahualilo, Estado Durango, Mexico.
163. Lovett, A. L., Agricultural College, Corvallis, Ore.
164. Lowry, Q. S., 2378 Washington St., Canton, Mass.
165. Luginbill, Philip, University of South Carolina, Columbia, S. C.
166. MacGillivray, A. D., University of Illinois, Urbana, Ill.
167. Mackie, D. B., State Insectary, Sacramento, Calif.
168. Marlatt, C. L., U. S. Bureau of Entomology, Washington, D. C.
169. Matheson, Robert, Cornell University, Ithaca, N. Y.
170 McColloch, J. W., Agricultural Experiment Station, Manhattan, Kan.
171. McDaniel, Eugenia, Agricultural College, East Lansing, Mich.
172. McGregor, E. A., Pacific Grove, Calif.
173. McLaine, L. S., Entomological Branch, Ottawa, Can.
174. Melander, A. L., Agricultural College, Pullman, Wash.
175. Merrill, G. B., Gainesville, Fla.
176. Merrill, J. H., Agricultural Experiment Station, Manhattan, Kan.
177. Metcalf, C. L., University of Illinois, Urbana, Ill.
178. Metcalf, Z. P., Agricultural Experiment Station, West Raleigh, N. C.
179. Milliken, F. B., Kirksville, Mo.
180. Moore, William, Entomological Laboratory, Riverton, N. J.
181. Morgan, A. C., U. S. Bureau of Entomology, Clarksville, Tenn.
182. Morgan, H. A., Agricultural Experiment Station, Knoxville, Tenn.
183. Morrill, A. W., 382 West Ave., 53, Los Angeles, Calif.
184. Morrison, Harold, U. S. Bureau of Entomology, Washington, D. C.
185. Morse, A. P., Wellesley, Mass.
186. Mosher, Edna, University of New Mexico, Albuquerque, N. Mex.
187. Mosher, F. H., U. S. Bureau of Entomology, Melrose Highlands, Mass.
188. Moznette, G. F., Box 1134, Miami, Fla.
189. Nelson, J. A., Mt. Vernon, Ohio.
190. Neuls, J. D., 337 S. Hoover St., Los Angeles, Calif.
191. Newcomber, E. J., Box 243, Yakima, Wash.
192. Newell, Wilmon, State Plant Commission, Gainesville, Fla.
193. Nougaret, R. L., 2916 E. St., Sacramento, Calif.
194. Oestlund, O. W., University of Minnesota, Minneapolis, Minn.
195. O'Kane, W. C., Agricultural Experiment Station, Durham, N. H.
196. Osborn, Herbert, Ohio State University, Columbus, Ohio.
197. Osborn, H. T., Hawaiian Sugar Planters' Experiment Station, Honolulu, H. T.
198. Osburn, Raymond C., Ohio State University, Columbus, Ohio.
199. Packard, C. M., 600 26th St., Sacramento, Calif.
200. Paddock, F. B., State Apiarist, Ames, Iowa.
201. Parker, J. R., Agricultural Experiment Station, Bozeman, Mont.
202. Parker, R. R., Agricultural College, Bozeman, Mont.
203. Parks, T. H., Ohio State University, Columbus, Ohio.
204. Parrott, P. J., Agricultural Experiment Station, Geneva, N. Y.
205. Patch, Edith M., Agricultural Experiment Station, Orono, Me.
206. Peairs, L. M., Agricultural Experiment Station, Morgantown, W. Va.
207. Pellett, F. C., Hamilton, Ill.
208. Pemberton, C. E., U. S. Bureau of Entomology, Honolulu, H. T.
209. Perkins, R. C. L., 4 Thurlestone Rd., Newton Abbot, Devon, England.
210. Peterson, Alvah, Entomology Building, New Brunswick, N. J.

211. Pettit, Morley, Georgetown, Ontario, Canada.
212. Pettit, R. H., Agricultural Experiment Station, East Lansing, Mich.
213. Phillips, E. F., U. S. Bureau of Entomology, Washington, D. C.
214. Phillips, W. J., U. S. Bureau of Entomology, Charlottesville, Va.
215. Pierce, W. D., Wisnom Bldg., San Mateo, Calif.
216. Poos, F. W., Entomological Laboratory, Charlottesville, Va.
217. Popenoe, C. H., U. S. Bureau of Entomology, Washington, D. C.
218. Quaintance, A. L., U. S. Bureau of Entomology, Washington, D. C.
219. Quayle, H. J., University of California, Riverside, Calif.
220. Reeves, George I., 1535 Edison St., Salt Lake City, Utah.
221. Regan, W. S., Agricultural College, Bozeman, Mont.
222. Richardson, C. H., Bureau of Entomology, Washington, D. C.
223. Riley, W. A., University Farm, St. Paul, Minn.
224. Rockwood, L. P., U. S. Bureau of Entomology, Forest Grove, Ore.
225. Ross, W. A., Vineland Station, Ontario, Canada.
226. Ruggles, A. G., University Farm, St. Paul, Minn.
227. Rumsey, W. E., Agricultural Experiment Station, Morgantown, W. Va.
228. Safro, V. I., Louisville, Ky.
229. Sanders, G. E., Entomological Branch, Annapolis Royal, N. S.
230. Sanders, J. G., Bureau Plant Industry, Harrisburg, Pa.
231. Sanderson, E. D., Cornell University, Ithaca, N. Y.
232. Sanford, H. L., Bureau of Entomology, Washington D. C.
233. Sasscer, E. R., U. S. Bureau of Entomology, Washington, D. C.
234. Satterthwait, A. F., U. S. Bureau of Entomology, Webster Groves, Mo.
235. Scammell, H. B., Toms River, N. J.
236. Schoene, W. J., Agricultural Experiment Station, Blacksburg, Va.
237. Schwarz, E. A., U. S., National Museum, Washington, D. C.
238. Scott, E. W., Rockville, Md.
239. Seamans, H. L., Ent. Lab., Lethbridge, Alberta.
240. Seigler, E. H., U. S. Bureau of Entomology, Washington, D. C.
241. Severin, H. C., Agricultural Experiment Station, Brookings, S. D.
242. Severin, H. H., 2310 Cedar St., Berkeley, Calif.
243. Shafer, G. D., 321 Melville Ave., Palo Alto, Calif.
244. Shelford, V. E., University of Illinois, Urbana, Ill.
245. Sherman, Franklin, Jr., Department of Agriculture, Raleigh, N. C.
246. Simanton, F. L., 549 Broadway, Benton Harbor, Mich.
247. Skinner, Henry, 1900 Race St., Philadelphia, Pa.
248. Smith, H. S., State Insectary, Sacramento, Calif.
249. Smith, L. V., Entomological Laboratory, Riverton, N. J.
250. Smith, R. C., Agricultural College, Manhattan, Kan.
251. Smith, R. I., 6 Beacon St., Boston, Mass.
252. Smulyan, M. T., U. S. Bureau of Entomology, Melrose Highlands, Mass.
253. Snapp, O. I., Bureau of Entomology, Fort Valley, Ga.
254. Snyder, T. E., U. S. Bureau of Entomology, Washington, D. C.
255. Stear, J. R., 431 Philadelphia Ave., Chambersburg, Pa.
256. Stearns, L. A., Leesburg, Va.
257. Strickland, E. H., Entomological Branch, Ottawa, Canada.
258. Summers, H. E., Agricultural Experiment Station, Ames, Iowa.
259. Summers, J. N., U. S. Bureau of Entomology, Melrose Highlands, Mass.
260. Swaine, J. M., Entomological Branch, Ottawa, Canada.
261. Swenk, M. H., Agricultural Experiment Station, Lincoln, Neb.

262. Swezey, O. H., Hawaiian Sugar Planters' Experiment Station, Honolulu, H. T.
263. Symons, T. B., Agricultural Experiment Station, College Park, Md.
264. Tanquary, M. C., College Station, Texas.
265. Thomas, F. L., Auburn, Ala.
266. Timberlake, P. H., Hawaiian Sugar Planters' Experiment Station, Honolulu, H. T.
267. Titus, E. G., 673 Sixth Ave., Salt Lake City, Utah.
268. Tothill, J. D., Entomological Branch, Fredericton, N. B.
269. Treherne, R. C., Entomological Branch, Ottawa, Canada.
270. Troop, James, Agricultural Experiment Station, LaFayette, Ind.
271. Tucker, E. S., Tallulah, La.
272. Turner, W. F., Blue Ridge, Ga.
273. Urbahns, T. D., State Insectary, Sacramento, Calif.
274. Van Dine, D. L., Mound Laboratory, Mound, La.
275. Van Dyke, E. C., University of California, Berkeley, Calif.
276. Van Zwaluwenberg, R.H., United Sugar Companies, Los Mochis, Sinaloa, Mexico.
277. Vickery, R. A., Bureau of Entomology, Abbott Bldg., Cambridge, Mass.
278. Viereck, H. L., Bureau of Biological Survey, Washington, D. C.
279. Wade, J. S., U. S. Bureau of Entomology, Washington, D. C.
280. Walden, B. H., Agricultural Experiment Station, New Haven, Conn.
281. Walton, W. R., U. S. Bureau of Entomology, Washington, D. C.
282. Washburn, F. L., University Farm, St. Paul, Minn.
283. Webb, J. L., U. S. Bureau of Entomology, Washington, D. C.
284. Webster, R. L., Agricultural College, N. D.
285. Weigel, C. A., Federal Horticultural Board, Washington, D. C.
286. Weiss, H. B., Agricultural Experiment Station, New Brunswick, N. J.
287. Weldon, G. P., Chaffee Union High School, Ontario, Calif.
288. Wheeler, W. M., Bussey Institution, Forest Hills, Mass.
289. Wildermuth, V. L., U. S. Bureau of Entomology, Tempe, Ariz.
290. Wilson, H. F., University of Wisconsin, Madison, Wis.
291. Woglum, R. S., California Fruit Growers' Exchange, Consolidated Realty Bldg., Los Angeles, Calif.
292. Wolcott, G. N., Box 1281, San Juan, P. R.
293. Wood, H. P., 306 Mohawk Ave., Scotia, N. Y.
294. Wood, W. B., U. S. Bureau of Entomology, Washington, D. C.
295. Woods, W. C., Wesleyan University, Middletown, Conn.
296. Worthley, L. H., Abbott Bldg., Harvard Square, Cambridge, Mass.
297. Yothers, M. A., 1514 N. Main St., Medford, Ore.
298. Yothers, W. W., U. S. Bureau of Entomology, Orlanda, Fla.
299. Zappe, Max P., Agricultural Experiment Station, New Haven, Conn.
300. Zetek, James, Ancon, Canal Zone, Panama.

ASSOCIATE MEMBERS

301. Albert, Theodore, Chehalis, Wash.
302. Alden, C. H., Entomological Laboratory, Fort Valley, Ga.
303. Allen, H. W., Agricultural College, Miss.
304. Allen, R. H., Board of Agriculture, State House, Boston, Mass.
305. Anderson, C. S., 24 S. Dewberry St., Harrisburg, Pa.
306. Anderson, G. M., Clemson College, S. C.
307. Arnold, George G., Agricultural College, Miss.

308. Ayres, Ed. L., College Station, Texas.
309. Babcock, O. G., Box 322, Sonora, Texas.
310. Baerg, William J., Fayetteville, Ark.
311. Bailey, H. L., Bradford, Vt.
312. Bailey, I. L., Northboro, Mass.
313. Balduf, W. V., B. & Z. Bldg., Ohio State University, Columbus, Ohio.
314. Barnes, P. T., 1726 Regina St., Harrisburg, Pa
315. Barnes, William, Decatur, Ill.
316. Bartlett, Oscar C., Phoenix, Ariz.
317. Bartley, H. W., 40 Hanover Rd., Silver Creek, N. Y.
318. Batchelder, C. H., 38 N. Main St., Orono, Maine.
319. Bauer, Frederick, Storrs, Conn.
320. Bazeley, W. A. L., 519 State House, Boston, Mass.
321. Beckwith, C. S., Agricultural Experiment Station, New Brunswick, N. J.
322. Bedford, Theo., Wellcome Tropical Research Laboratory, Khartoum, Sudan.
323. Bensel, G. E., Spreckels, Calif.
324. Beutenmuller, William, Box 258, Highwood, Bergen Co., N. J.
325. Black, A. B., Agricultural College, Corvallis, Ore.
326. Blanchard, E. E., San Isidro, Argentina.
327. Blanchard, R. A., Entomological Laboratory, Webster Groves, Mo.
328. Borodin, D. N., Room 1003, 110 W. 40th St., New York, N. Y.
329. Bower, L. J., 317 E. Pine St., Seattle, Wash.
330. Boyden, B. L., Daytona, Fla.
331. Bradley, G. H., Mound Laboratory, Mound, La.
332. Bradley, W. G., Agricultural Experiment Station, Baton Rouge, La.
333. Brannon, C. H., Greenville, Miss.
334. Braucher, R. W., 548 N. Pine Ave., Austin Station, Chicago, Ill.
335. Bridwell, J. C., Address unknown.
336. Brimley, C. S., Department of Agriculture, Raleigh, N. C.
337. Brinley, F. J., Entomological Laboratory, Riverton, N. J.
338. Broadbent, Bessie M., 1812 Ingleside Terrace, Washington, D. C.
339. Brock, A. A., Santa Paula, Calif.
340. Brown, Luther, Agricultural College, Miss.
341. Brundrett, H. M., Box 208, Dallas, Texas.
342. Buck, J. E., Rural Retreat, Va.
343. Butcher, Fred D., Ames, Iowa.
344. Bynum, E. K., Box 331, Gulfport, Miss.
345. Carpenter, H. B., 58 Central St., Somerville, Mass.
346. Carroll, Mitchell, Agricultural Experiment Station, New Brunswick, N. J.
347. Cartwright, William B., Box 283, Centralia, Ill.
348. Chafin, Jeff, Gainesville, Fla.
349. Chamberlain, K. F., Cornwall Bridge, Conn.
350. Chamberlin, F. S., Quincy, Fla.
351. Chamberlin, T. R., 1525 Edison St., Salt Lake City, Utah.
352. Chambers, E. L., c/o State Entomologist, Madison, Wis.
353. Champlain, A. B., Bureau Plant Industry, Harrisburg, Pa.
354. Chandler, S. C., 402 W. Walnut St., Carbondale, Ill.
355. Chapman, J. W., Silliman Institute, Dumagueta, P. I.
356. Chrystal, R. N., Entomological Branch, Ottawa, Can.
357. Claason, P. W., 102 Irving Pl., Ithaca, N. Y.
358. Clapp, S. C., Mountain Branch Station, Swannanoa, N. C.

359. Coe, Wesley R., Yale University, New Haven, Conn.
360. Coleman, G. A., University of California, Berkeley, Calif.
361. Compton, C. S., Natural History Bldg., Urbana, Ill.
362. Cook, William O., c /o State Entomologist, Bozeman, Mont.
363. Corbett, G. H., The Gretna, Trowbridge, Wiltshire, England.
364. Craig, D. H., 10 Court St., Arlington, Mass.
365. Craighead, E. M., Bureau Plant Industry, Harrisburg, Pa.
366. Crawford, H. G., Entomological Branch, Ottawa, Canada.
367. Culver, J. J., Vienna, Va.
368. Currie, R. P., U. S. Bureau of Entomology, Washington, D. C.
369. Currier, D. L., c /o San Jose Spray Mfg. Co., San Jose, Calif.
370. Cutrer, T. H., Agricultural Experiment Station, Baton Rouge, La.
371. Darlington, P. S., Wenatchie, Wash.
372. Day, L. H., Hollister. Calif.
373. Dean, M. L., c /o Coop. Fruit Growers Association, Wenatchee, Wash.
374. Del Curto, J. M., Department of Agriculture, Austin, Texas.
375. Deputy, O. D., Box 499, Brownsville, Tex.
376. Detwiler, J. D., 115 Eddy St., Ithaca, N. Y.
377. Dickerson, E. L., 106 Prospect St., Nutley, N. J.
378. Dodds, Clifford T., 2344 Eunice St., Berkeley, Calif.
379. Dohanian, S. M., U. S. Bureau of Entomology, Melrose Highlands, Mass.
380. Dolbin, D. L., Box 680, Freeland, Pa.
381. Doucette, C. F., Doylestown, Pa.
382. Douglass, B. W., Trevlac, Ind.
383. Douglass, J. R., 6427 First Ave., Birmingham, Ala.
384. Downes, W., Dominion Entomological Laboratory, Dept. Agriculture, Victoria, B. C.
385. Dozier, H. L., Agricultural College, Miss.
386. Drake, C. J., College of Forestry, Syracuse, N. Y.
387. Dudley, J. E., Jr., U. S. Bureau of Entomology, Madison, Wis.
388. Dye, H. W., Bailey Hall, Ithaca, N. Y.
389. Eckert, J. E., Raleigh, N. C
390. Eddy, M. W., Cor. W. & B St., Carlisle, Pa.
391. Ellis, W. O., 10 Court St., Arlington, Mass.
392. Emery, W. T., San Benito, Tex.
393. English, Lester L., 6427 First Ave., Birmingham, Ala.
394. Eyer, J. R., Girard, Pa.
395. Fackler, H. L., Knoxville, Tenn.
396. Farrar, Edward R., South Lincoln, Mass.
397. Fattig, P. W., 207 Pine St., Farmville, Va.
398. Fisher, C. K., Address unknown.
399. Fisher, W. S., U. S. National Museum, Washington, D. C.
400. Fiske, R. J., Lunenburg, Mass.
401. Fluke, C. L., Jr., University of Wisconsin, Madison, Wis.
402. Fort, Harold M., Hamilton, Mo.
403. Frank, Arthur, West Washington Experiment Station, Puyallup, Wash.
404. Frison, Theodore Henry, Box 69, Riverton, N. J.
405. Garrison, Gwynn L., Tallulah, La.
406. Gentner, L. G., 213 Bailey St., East Lansing, Mich.
407. Gibson, E. H., R. R. 1, Alexandria, Va.
408. Giffard, W. M., Box 308, Honolulu, H. T.

409. Gilbertson, G. J., Brookings, S. D.
410. Glick, Perry A., 605 E. Daniel St., Champaign, Ill.
411. Goodwin, James C., Box 138, Gainesville, Fla.
412. Graham, F. W., 1 W. Main St., Somerville, N. J.
413. Gram, Ernest, Statens Plantspatologiske, Lyngby, Denmark.
414. Green, E. C., 1101 W. Green St., Urbana, Ill.
415. Grimes, D. W., Agricultural College, Miss.
416. Griswold, Grace Hall, 126 Roberts Place, Ithaca, N. Y.
417. Gunderson, A. J., c /o Sherwin-Williams Co., Cleveland, Ohio.
418. Haber, V. R., 225 Lincoln Ave., Raleigh, N. C.
419. Hain, R. M., Agricultural College, East Lansing, Mich.
420. Hambleton, James T., 423 Dorset Ave., Chevy Chase, Washington, D. C.
421. Hamilton, C. C., State College, College Park, Md.
422. Hamlin, J. C., 702 Carter Bldg., Houston, Texas.
423. Hargreaves, Ernest, Imperial College of Science and Technology, S. Kensington, London, S. W. 7, England.
424. Harwood, R. W., Natural History Bldg., Urbana, Ill.
425. Hawkins, Kenneth, Watertown, Wis.
426. Henderson, W. W., Agricultural Experiment Station, Logan, Utah.
427. Hertzog, P. H., Hightstown, N. J.
428. Hester, J. G., Box 1, Agricultural College, Miss.
429. Hill, C. C., 227 Moreland Ave., Carlisle, Pa.
430. Hoddy, E. J., 1713 Yale Ave., Knoxville, Tenn.
431. Hodgson, B. E., 10 Court St., Arlington, Mass.
432. Hofer, C. E., Silver Creek, N. Y.
433. Hoffman, William A., Dept. Medical Zoology, School of Public Health & Hygiene, Johns Hopkins University, Baltimore, Md.
434. Hoffmann, William E., Div. of Entomology, University Farm, St. Paul, Minn.
435. Hoke, Gladys, Agricultural College, Miss.
436. Holbrook, J. E. R., U. S. Bureau of Entomology, Melrose Highlands, Mass.
437. Hollister, W. O., Kent, Ohio.
438. Hood, C. E., U. S. Bureau of Entomology, Melrose Highlands, Mass.
439. Hood, J. D., Biological Survey, Washington, D. C.
440. Horsfall, J. L., State College Laboratory, Bustleton, Pa.
441. Horton, Harvey A., Eagle Pass, Texas.
442. Huber, L. L., Ohio State University, Columbus, Ohio.
443. Huckett, H. C., Farm Bureau, Mineola, N. Y.
444. Hudson, G. H., Plattsburg, N. Y.
445. Hunt, Chris M., Clearwater, Fla.
446. Hutson, J. C., Royal Botanic Gardens, Peradeniya, Ceylon.
447. Ingerson, H. G., 264 Brighton Road, Columbus, Ohio.
448. Jaenicke, Alex. J., U. S. Forest Service, Portland, Ore.
449. Jaques, H. E., Mt. Pleasant, Iowa.
450. Jewett, H. H., Agricultural Experiment Station, Lexington, Ky.
451. Jones, Edward R., Box 346, Clarksville, Tenn.
452. Jones, W. W., 700 McCormack Building, Salt Lake City, Utah.
453. Kannan, K. K., Stanford University, Calif.
454. Keler, Stefan, Lemberg, Tarnowskiego 45, Poland.
455. Kelly, E. B., 214 Columbia Bldg., Spokane, Wash.
456. Kelty, R. H., Agricultural College, East Lansing, Mich.
457. Kidder, Nathaniel T., Milton, Mass.

458. Kimball, H. H., Agricultural College, Miss.
459. Kimsey, M. E., Address unknown.
460. King, K. M., Entomological Laboratory, Charlottesville, Va.
461. Kinsey, A. C., University of Indiana, Bloomington, Ind.
462. Kirk, H. B., 1902 North St., Harrisburg, Pa.
463. Knull, Josef N., Hummelstown, Pa.
464. Koebele, Albert, Waldkirch i Br., Baden, Germany.
465. Kraus, E. J., Experiment Station, Madison, Wis.
466. Laake, E. W., U. S. Bureau of Entomology, Dallas, Texas.
467. Lancaster, Herman B., 6427 First Ave., Birmingham, Ala.
468. Landers, D. D., Nahant & Farm Sts., Wakefield, Mass.
469. Lane, Merton C., Box 498, Ritzville, Wash.
470. Langston, J. M., Agricultural College, Miss.
471. Lauderdale, J. L. E., Weilemman, Miss.
472. Leach, B. R., Entomological Laboratory, Riverton, N. J.
473. Ledyard, E. M., Salt Lake City, Utah.
474. Lewis, A. C., Capitol Building, Atlanta, Ga.
475. Lewis, C. W., 28 Albion St., Melrose Highlands, Mass.
476. Littler, F. M., 65 High St., Launceston, Tasmania.
477. Lobdell, R. N., Agricultural College, Miss.
478. Lockwood, Stewart, Agricultural College, N. D.
479. Lowry, Philip R., Durham, N. H.
480. Mabee, W. B., Department of Agriculture, Raleigh, N. C.
481. Maheux, George, Department of Agriculture, Quebec, Canada.
482. Maloney, J. O., Agricultural College, Miss.
483. Mann, B. P., 1918 Sunderland Pl., Washington, D. C.
484. Manter, J. A., Connecticut Agricultural College, Storrs, Conn.
485. Marcovitch, S., Agricultural Experiment Station, Knoxville, Tenn.
486. Martin, J. F., Bureau Plant Industry, Washington, D. C.
487. Mason, A. C., Box 491, Orlando, Fla.
488. Mason, P. W., Bureau of Entomology, Washington, D. C.
489. Maxon, Asa C., Longmont, Calif.
490. McDonald, R. E., Department of Agriculture, Austin, Texas.
491. McDonough, F. L., Address unknown.
492. McEvilly, J. E., Box 1, Agricultural College, Miss.
493. McIntosh, Allen, Agricultural College, Miss.
494. McIntyre, H. L., 964 Main St., Melrose Highlands, Mass.
495. McMahon, E. A., 9 Delhousie St., Montreal, Can.
496. Menagh, C. S., U. S. Bureau of Entomology, Washington, D. C
497. Mendenhall, E. W., 97 Brighton Rd., Columbus, Ohio.
498. Merrill, D. E., Rogers, Ark.
499. Millen, F. E., Apiculture Department, Guelph, Canada.
500. Miller, A. E., 67 W. 10th Ave., Columbus, Ohio.
501. Minott, C. W., Melrose Highlands, Mass.
502. Mitchell, T. B., Department of Agriculture, Raleigh, N. C.
503. Montgomery, J. H., State Plant Board, Gainesville, Fla.
504. Moreland, R. W., U. S. Bureau of Entomology, Tallulah, La.
505. Mote, Don C., Box 348, Phoenix, Ariz.
506. Muesebeck, C. F. W., U. S. Bureau of Entomology, Melrose Highlands, Mass.
507. Nakayama, Shonosuke, Imperial Plant Quarantine Station, Yokohama, Japan.
508. Ness, Henry, Ames, Iowa.

509. Newbegin, I. B., Wakefield, Mass.
510. Newton, J. H., Paonia, Colo.
511. Nickels, C. B., R. D. 1, Box 63, Charleston, S. C.
512. Nininger, H. H., Address unknown.
513. Nolan, Willis J., 423 Dorset Ave., Chevey Chase Sta., Washington, D. C.
514. O'Byrne, F. M., Gainesville, Fla.
515. O'Rourke, F. L., 10 Court St., Arlington, Mass.
516. Osgood, W. A., New Hampshire College, Durham, N. H.
517. Paarmann, J. H., 1532 Clay St., Davenport, Iowa.
518. Pack, Herbert J., Utah Agricultural College, Logan, Utah.
519. Painter, H. R., Box 95, West Lafayette, Ind.
520. Palmer, R. G., Central Y. M. C. A., Rochester, N. Y.
521. Park, Wallace, Ames, Iowa.
522. Parker, H. L., 10 Court St., Arlington, Mass.
523. Parks, H. B., Box 838, San Antonio, Texas.
524. Parman, D. C., Uvalde, Texas.
525. Partridge, N. L., Michigan Agricultural College, E. Lansing, Mich.
526. Peake, G. W., University Farm, St. Paul, Minn.
527. Pearson, G. B., Box 95, West Lafayette, Ind.
528. Peirson, H. B., Dept. Forestry, State House, Augusta, Me.
529. Penny, D. D., Watsonville, Calif.
530. Phillips, Saul, Saugus, Mass.
531. Phipps, Clarence R., Experiment Station, Mountain Grove, Mo.
532. Pillsbury, J. J., Board of Agriculture, Providence, R. I.
533. Plank, H. K., U. S. Bureau of Entomology, Washington, D. C.
534. Pollock, J. H., Box 423, Colorado Springs, Colo.
535. Porter, B. A., U. S. Bureau of Entomology, Washington, D. C.
536. Powers, E. B., University of Nebraska, Lincoln, Neb.
537. Price, W. A., Purdue University, LaFayette, Ind.
538. Primm, James K., Oak Lane, Pa.
539. Rea, George H., State College, Pa.
540. Readeo, Phillip, Lawrence, Kan.
541. Reed, W. V., Capitol Building, Atlanta, Ga.
542. Reeher, Max M., Forest Grove, Ore.
543. Reese, C. A., State Plant Board, Gainesville, Fla.
544. Reinhard, H. J., College Station, Texas.
545. Reppert, R. R., College Station, Texas.
546. Ressler, I. L., Ames, Iowa.
547. Richardson, T. R., Abbott Bldg., Cambridge, Mass.
548. Ricker, D. A., Box 95, West LaFayette, Ind.
549. Riley, George E., Agricultural College, Miss.
550. Robinson, C. L., Court House, Yakima, Wash.
551. Robinson, J. M., Experiment Station, Auburn, Ala.
552. Rogers, D. M., U. S. Bureau of Entomology, 6 Beacon St., Boston, Mass.
553. Rolfs, P. H., Bello Horizonte, Estado Minas Geraes, Brazil.
554. Root, E. R., Medina, Ohio.
555. Rosewall, O. W., State University, Baton Rouge, La.
556. Rounds, M. B., 993 Pasadena Ave., Azusa, Calif.
557. Ryan, H. J., 907 Hall of Records, Los Angeles, Calif.
558. Schaffner, J. V. Jr., Melrose Highlands, Mass.
559. Scholl, E. E., Capitol Building, Austin, Texas.

560. Scott, W. M., Office of Markets, Dept. of Agriculture, Washington, D. C.
561. Scullen, H. A., Agricultural College, Corvallis, Ore.
562. Searls, E. L., Madison, Wisc.
563. Shaw, N. E., Bronson Bldg., Columbus, Ohio.
564. Simmons, Perez, U. S. Bureau of Entomology, Washington, D. C.
565. Smith, Charles E., Experiment Station, Baton Rouge, La.
566. Smith, G. A., State Forester's Office, State House, Boston, Mass.
567. Smith, G. E., Albion, N. Y.
568. Smith, H. E., Randolph, Vt.
569. Smith, M. R., Agricultural College, Miss.
570. Smith, R. H., Twin Falls, Idaho.
571. Snow, S. J., Address unknown.
572. Somes, M. P., Kalispell, Mont.
573. Spangler, A. J., 206 S. College Ave., Fort Collins, Colo.
574. Speaker, H. J., Sandusky, Ohio.
575. Spencer, Herbert, West Raleigh, N. C.
576. Spessard, L. L., 1624 P. St., N. W., Washington, D. C.
577. Spooner, Charles, 1508 S. 3d St., Charleston, Ill.
578. Spuler, Anthony, Agricultural Experiment Station, Pullman, Wash.
579. Stafford, E. W., Agricultural College, Miss.
580. Stage, H. H., 700 Pine St., Pine Bluff, Ark.
581. Stahl, C. F., Citrus Experiment Station, Riverside, Calif.
582. Stiles, C. F., Agricultural Experiment Station, Stillwater, Okla.
583. Stirling, Frank, State Plant Board, Gainesville, Fla.
584. Stockwell, C. W., Entomological Laboratory, Riverton, N. J.
585. Strand, A. L., 319 S. Black Ave., Bozeman, Mont.
586. Sullivan, K. C., Columbia, Mo.
587. Swain, A. F., 3128 Balch Ave., Fresno, Calif.
588. Taft, L. R., East Lansing, Mich.
589. Talbert, T. J., Agricultural College, Manhattan, Kan.
590. Taylor, L. H., Bussey Institution, Boston 30, Mass.
591. Thomas, C. A., Bustleton, Pa.
592. Thomas, W. A., Chadbourn, N. C.
593. Thompson, B. G., 600 26th St., Sacramento, Calif.
594. Tillery, J. L., Concord, Tenn.
595. Tower, D. G., Room 305, Custom House, New York, N. Y.
596. Tower, W. V., Mayaguez, P. R.
597. Trimble, F. M., Camp Hill, Cumberland Co., Pa.
598. Turner, C. F., 1940 Felix Ave., Memphis, Tenn.
599. Turner, W. B., 600 26th St., Sacramento, Calif.
600. Uichanco, L. B., College of Agriculture, Los Banos, P. I.
601. Underhill, G. W., Box 156, Chester, Pa.
602. Van Duzee, E. P., Academy of Science, Golden Gate Park, San Francisco, Calif.
603. Vickery, R. K., Box 340, Saratoga, Calif.
604. Wadley, F. M., 126 S. Minneapolis Ave., Wichita, Kan.
605. Wakeland, C. C., University of Idaho, Boise, Idaho.
606. Walkden, H. H., 126, S. Minneapolis Ave., Wichita, Kan.
607. Wallace, F. N., State Entomologist, Indianapolis, Ind.
608. Walter, E. V., Tempe, Ariz.
609. Warren, Don. C., Valdosta, Ga.
610. Watson, J. R., Gainesville, Fla.

611. Watts, H. R., Knoxville, Tenn.
612. Webber, R. T., U. S. Bureau of Entomology, Melrose Highlands, Mass.
613. Weed, C. M., State Normal School, Lowell, Mass
614. Wehr, E. E., Star, Idaho.
615. Wehrle, L. P., Roberts Hall, Ithaca, N. Y.
616. Wellhouse, Walter, Dept. Zoology & Entomology, I. A. C., Ames, Iowa.
617. Wells, R. W., Box 208, Dallas, Texas.
618. Whelan, Don B., Midland, Mich.
619. Whitcomb, W. D., Yakima, Wash.
620. White, W. H., College Park, Md.
621. Whitmarsh, R. D., Milwaukee, Wis.
622. Williams, C. B., 20 Slatey Road, Birkenhead, England.
623. Williamson, Warren, 402 S. Academy St., Galesburg, Ill.
624. Willson, R. B., Agricultural College, Miss.
625. Winchester, H. I., Melrose Highlands, Mass.
626. Woodworth, H. E., College of Agriculture, Los Banos, P. I.
627. Wooldridge, Reginald, U. S. Bureau of Entomology, Melrose Highlands, Mass.
628. Worthley, H. N., Dept. Entomology, M. A. C., Amherst, Mass.
629. Young, A. W., South Yarmouth, Mass.
630. Young, D. B., State Museum, Albany. N. Y.
631. Young, M. T., Tallulah, La.
632. Yuasa, Hachiro, Natural History Bldg., University of Illinois, Urbana, Ill.

FOREIGN MEMBERS

Anderson, T. G., Nairobi, British East Africa.
Ballou, H. A., Imperial Department of Agriculture, Barbados, West Indies.
Berlese, Dr. Antonio, Reale Stazione di Entomologia, Agraria, Firenze, Italy.
Bordage, Edmond, Directeur de Musee, St. Denis, Reunion.
Brain, Charles K., Pretoria, South Africa.
Carpenter, Dr. George H., Royal College of Science, Dublin, Ireland.
Collinge, W. E., 55 Newhall St., Birmingham, England.
Danysz, J., Laboratoire de Parasitologie, Bourse de Commerce, Paris, France.
DeBussy, L. P., Deli, Sumatra.
Escherisch, K., Forstliche Versuchsaustalt, Universitat, Munich, Germany.
French, Charles, Department of Agriculture, Melbourne, Australia.
Froggatt, W. W., Department of Agriculture, Sydney, New South Wales.
Fuller, Claude, Department of Agriculture, Peitermaritzburg, Natal, South Africa.
Goding, F. W., Guayaquil, Ecuador, South America.
Grasby, W. C., 6 West Australian Chambers, Perth, West Australia.
Green, E. E., Way's End, Beach Ave., Camberley, Surry, England.
Herrera, A. L., Director de Estudios, Bibliogicas, Secretaria de Agricultura y Formento, Mexico, D. F. Mexico.
Hill, Gerald F., Townsville, North Queensland.
Horvath, Dr. G., Musee Nationale Hongroise, Budapest, Hungary.
Jablonowski, Josef, Entomological Station, Budapest, Hungary.
Jack, Rupert W., Salisbury, Rhodesia, South Africa.
Johnson, Thomas H., University of Brisbane, Queensland, Australia.
Kulagin, Nikolai M., Landwirtschaftliches Institut, Petrooskoje, Moskow, Russia
Kuwana, S. I., Imperial Agricultural Experiment Station, Yokohama, Japan.
Lea, A. M., National Museum, Adelaide, South Australia.

Lounsbury, Charles P., Department of Agriculture, Pretoria, Transvaal, South Africa.
Mally, C. W., Department of Agriculture, Cape Town, South Africa.
Marchal, Dr. Paul, 16 Rue Claude-Bernard, Paris, France.
Mokshetsky, Sigismond, Musee d'Histoire Naturelle, Simferopol, Crimea, Russia.
Mussem, Charles T., Hawkesbury Agricultural College, Richmond, New South Wales.
Nawa, Yashushi, Entomological Laboratory, Kyomachi, Gifu, Japan.
Newstead, Robert, University School of Tropical Medicine, Liverpool, England.
Porter, Carlos E., Casilla 2352, Santiago, Chili.
Pospielow, Dr. Waldemar, Station Entomologique, Rue de Boulevard, No. 9, Kiev, Russia.
Reed, Charles S., Mendoza, Argentine Republic, South America.
Ritzema Bos, Dr. J., Wageningen, Holland.
Rosenfeld, A. H., Ingenio Santa Ana, F. C. N. O. A., Tucuman, Argentina.
Sajo, Prof, Karl, Godollo-Veresegyhaz, Hungary.
Schoyen, Prof, W. M. Zoölogical Museum, Christiania, Norway.
Severin, Prof. G., Curator Natural History Museum, Brussels, Belgium.
Shipley, Prof. Arthur E, Christ's College, Cambridge, England.
Silvestri, Dr. F., R. Scuola Superiore di Agricoltura, Portici, Italy.
Theobald, Frederick V., Wye Court, Wye, Kent, England.
Thompson, Rev. Edward H., Franklin, Tasmania.
Tillyard, R. J., Cawthron Institute of Scientific Research, Nelson, New Zealand.
Tryon, H., Queensland Museum, Brisbane, Queensland, Australia.
Urich, F. W., Victoria Institute, Port of Spain, Trinidad, West Indies.
Vermorel, V., Station Viticole, Villefranche, Rhone, France.

JOURNAL
OF
ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

VOL. 15 FERUARY, 1922 No. 1

Proceedings of the Thirty-Fourth Annual Meeting of the American Association of Economic Entomologists

The thirty-fourth annual meeting of the American Association of Economic Entomologists was held at the University of Toronto, Toronto, Canada, December 29–31, 1921.

The meeting was called to order at 10.05 A. M., December 29, by President George A. Dean. The annual reports were read, routine business transacted, the address of the President was presented, also one paper on the program, before adjournment. At the afternoon session, the Presidential address was discussed and the program of papers presented. On that evening, the Section on Apiculture held its annual meeting. It was well attended and an interesting program was presented.

On Friday morning, December 30, the Section on Horticultural Inspection held its session. In the afternoon, the joint session between this association and the Entomological Society of Ontario, was held. The program for the day was concluded with a dinner at the Prince George Hotel, at which over 140 entomologists were present.

On Saturday morning, December 31st, a joint session was held with the American Phytopathological Society, at the University of Toronto. The final session was held on the afternoon of that day, and consisted of moving pictures, papers, and transaction of final business.

The business proceedings form Part I of this report, and the addresses, papers, and discussions Part II.

The proceedings of the Sections on Apiculture and Horticultural Inspection will be prepared by the sectional secretaries and published as a part of this report.

The papers given at the joint session with the Entomological Society of Ontario will be published as may be agreed between the two so-

cieties, and this year the papers and discussion at the joint meeting with the American Phytopathological Society will be printed in their official publication, Phytopathology.

PART I. BUSINESS PROCEEDINGS

The meeting was called to order by President Dean, at 10.05 A. M., Thursday, December 29, 1921. About 150 members and visitors attended the sessions. The following members were present:

Ainslie, George G., R. R. 9, Knoxville, Tenn.
Aldrich, J. M., Washington, D. C.
Back, E. A., Washington, D. C.
Baker, A. C., Washington, D. C.
Baker, A. W., Guelph, Canada.
Balduf, W. V., Columbus, Ohio.
Ball, E. D., Washington, D. C.
Barnes, P. T., Harrisburg, Pa.
Bentley, G. M., Knoxville, Tenn.
Bethune, C. J. S., Guelph, Canada.
Bilsing, S. W., College Station, Texas.
Bishopp, F. C., Dallas, Texas.
Blackman, M. W., Syracuse, N. Y.
Borodin, D. N., New York, N. Y.
Brittain, W. H., Truro, N. S.
Britton, W. E., New Haven, Conn.
Burgess, A. F., Melrose Highlands, Mass
Caesar, Lawson, Guelph, Canada.
Cartwright, William B., Centralia, Ill.
Chandler, W. L., East Lansing, Mich.
Chapman, R. N., Minneapolis, Minn.
Claason, P. W., Ithaca, N. Y.
Comstock, J. H., Ithaca, N. Y.
Cooley, R. A., Bozeman, Mont.
Cotton, E. C., Columbus, Ohio.
Crawford, H. G., Ottawa, Canada
Criddle, Norman, Manitoba, Can.
Crosby, C. R., Ithaca, N. Y.
Davis, J. J., LaFayette, Ind.
Dean, George A., Manhattan, Kan.
DeLong, Dwight M., Harrisburg, Pa.
Downes, W., Victoria, B. C.
Dozier, H. L., Agricultural College, Miss.
Drake, C. J., Syracuse, N. Y.
Dusham, E. H., State College, Pa.
Ewing, H. E., Washington, D. C.
Fackler, H. L., Knoxville, Tenn.
Felt, E. P., Albany, N. Y.
Flint, W. P., Urbana, Ill.
Forbes, S. A., Urbana, Ill.
Fracker, S. B., Madison, Wis.
Frost, S. W., Arendtsville, Pa.
Gibson, Arthur, Ottawa, Canada.
Glenn, P. A., Urbana, Ill.
Gossard, H. A., Wooster, Ohio.
Griswold, Grace H., Ithaca, N. Y.
Guyton, T. L., Harrisburg, Pa
Hadley, C. H., Jr., Riverton, N.
Harned, R. W., Agricultural College, Miss.
Haseman, Leonard, Columbia, Mo.
Headlee, T. J., New Brunswick, N. J.
Herrick, Glenn W., Ithaca, N. Y.
Hodgkiss, H. E., State College, Pa.
Horton, J. R., Wichita, Kan.
Houser, J. S., Wooster, Ohio.
Howard, L. O., Washington, D. C.
Howard, Neale F., Birmingham, Ala.
Huckett, H. C., Ithaca, N. Y.
Hungerford, H. B., Lawrence, Kan.
Hunter, S. J., Lawrence, Kan.
Kelly, E. G., Manhattan, Kan.
Kennedy, C. H., Columbus, Ohio.
Larrimer, W. H., West LaFayette, Ind.
Leonard, M. D., New York, N. Y.
Lowry, Philip R., Durham, N. H
Matheson, Robert, Ithaca, N. Y.
McColloch, J. W., Manhattan, Kan.
McDaniel, Eugenia, East Lansing, Mich.
McLaine, L. S., Ottawa, Canada.
Metcalf, C. L., Columbus, Ohio.
Metcalf, Z. P., West Raleigh, N. C.
Millen, F. E., Guelph, Canada.
Moore, William, Riverton, N. J.
Mosher, Edna, Albuquerque, N. Mex.
Ness, Henry, Ames, Iowa.
Nolan, W. J., Washington, D. C.
O'Kane, W. C., Durham, N. H.
Osborn, Herbert, Columbus, Ohio.
Osburn, Raymond C., Columbus, Ohio.

Parks, T. H., Columbus, Ohio.
Parrott, P. J., Geneva, N. Y.
Patch, Edith M., Orono, Me.
Peairs, L. M., Morgantown, W. Va.
Peterson, Alvah, New Brunswick, N. J.
Phillips, E. F., Washington, D. C.
Quaintance, A. L., Washington, D. C.
Rea, George H., State College, Pa.
Riley, W. A., St. Paul, Minn.
Rockwood, L. P., Forest Grove, Ore.
Ross, W. A., Vineland Station, Canada.
Ruggles, A. G., St. Paul, Minn.
Sanders, G. E., Annapolis Royal, N. S.
Sanders, J. G., Harrisburg, Pa.
Sasscer, E. R., Washington, D. C.
Satterthwait, A. F., Webster Groves, Mo.
Seamans, H. L., Lethbridge, Alberta.
Stearns, L. A., Leesburg, Va.
Strickland, E. H., Ottawa, Canada.
Swaine, J. M., Ottawa, Canada.
Tanquary, M. C., College Station, Texas.
Tothill, J. D., Fredericton, N. B.
Treherne, R. C., Vernon, B. C.
Wallace, F. N., Indianapolis, Ind.
Walton, W. R., Washington, D. C.
Watson, J. R., Gainesville, Fla.
Webster, R. L., Agricultural College, N. D.
Weigel, C. A., Washington, D. C.
Whelan, Don B., Midland, Mich.
Whitmarsh, R. D., Milwaukee, Wis.

PRESIDENT GEORGE A. DEAN: The meeting will please come to order.

Some thirty odd years ago, a few men met in the city of Toronto and organized this association of Economic Entomologists. The long record of the association's usefulness has certainly justified this venture, which was launched so many years ago by these men of enthusiasm, earnestness, zeal and vision. Beginning with less than a dozen charter members, it has had a rapid and healthy growth and now numbers nearly 700 members, including nearly 50 foreign entomologists. As President of this Association, I want to pay my respects to those men for their splendid spirit of sacrifice which led them to devote their time and energy to the study of insects.

We will now have the report of the Secretary.

REPORT OF THE SECRETARY

At the Chicago meeting, the total membership of the association was 600, divided as follows: active, 242; associate, 311; and foreign, 47. At that meeting, 70 associate and 2 foreign members were elected, 1 associate member re-instated, and 45 were transferred from the associate to the active roll. One active and 5 associate members resigned, and during the present year, 3 active and 10 associate members have been dropped from the roll for non-payment of dues. One active member and one foreign member died during the year. The present membership is 282 active, 322 associate, and 48 foreign members, making a total of 652, a net gain of 52.

On February 22, Professor Charles H. Fernald passed away at his home in Amherst, Mass. He was one of the pioneer teachers of entomology in this country and was widely known and respected by the entomological fraternity throughout the world. He was a charter member of this association and one of its past presidents. He was nearly 83 years old at the time of his death, and owing to failing health had not attended the annual meetings of the association in recent years.

Professor N. A. Cholodkovsky, a foreign member of this association, died at Petrograd, Russia, at the age of 61 years. The exact date of his death is not known. He was the author of numerous works on entomology.

The Pacific Slope Branch held its annual meeting at Berkeley, California, Aug. 4—5, 1921. It was well attended and the report has been published in the JOURNAL OF ECONOMIC ENTOMOLOGY.

In accordance with the action taken at the St. Louis meeting, certificates for the past presidents of the association have been prepared by the Secretary and will be issued soon.

JOURNAL OF ECONOMIC ENTOMOLOGY

During the past year, a new contract has been placed for publishing the JOURNAL OF ECONOMIC ENTOMOLOGY, the price of printing it being advanced about 10 or 15 per cent. The February and April issues were published nearly on time, but owing to labor troubles which developed into a protracted strike in the printing plant of our publishers, the other issues for the year were greatly delayed. The June issue was not mailed until late in October and the August issue about the middle of November. The October and December issues should be distributed before the end of the year. This delay in publication has caused considerable dissatisfaction among our subscribers, and has made the work connected with the JOURNAL for the year more difficult than usual.

A substantial balance is shown on the JOURNAL statement at the time of closing the books. This condition is due principally to the fact that bills have not been received for the June or other issues following, and when these are met, the balance will be less than the amount on hand last year.

While it is not anticipated that the price of printing will increase during the coming year, the situation is such that the JOURNAL can scarcely publish the present volume of matter on the funds received annually. If the number of printed pages is to remain at the present level, the income of the JOURNAL should be slightly increased. The most feasible way of doing this appears to be to increase the number of subscribers. If the members of the association would interest themselves in this matter, it should be possible to increase the subscription list enough so that a larger volume of matter could be published than heretofore. If this is not done, it will doubtless be necessary to increase the price of the JOURNAL at the beginning of the next calendar year, and it is recommended that the Editorial Board be authorized to increase the rate $1.00 per volume in case this action seems necessary.

INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY, I

During the past year, a considerable number of copies of this Index have been sold and a balance now remains in the Treasury as a credit to this fund. There are on hand 400 unbound copies of this Index. As soon as there is sufficient money in this fund to defray the expense, these copies should be bound and placed in cartons. This will protect them from becoming soiled or disfigured, and they can then be held until they are sold.

INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY, II

This Index was completed and mailed about May 1st. The entire issue of 1000 copies was bound, but only 500 were enclosed in cartons. As soon as sufficient funds are available, the remaining 500 should be placed in cartons.

The Secretary was authorized to borrow $1500 to assist in financing this publication. Owing to the delay in issuing the book, and because a number of belated subscriptions were received, it was found at the time printing was completed, that only $1400,

in addition to the amount received from advance subscriptions, was needed to finance the publication. This fund was secured as follows:

$550 was transferred from the Association Treasury;
$100 from the Index No. I fund; and
$750 was borrowed from members on $25 notes, without interest.

At the time of closing the books, December 2d, 1921, sufficient sales had been made so that $650 covered by notes, have been re-paid. The Index II project shows a total debit of $750. A number of orders have been filled for which payment has not yet been received, and copies are being sold from time to time.

Inasmuch as this publication, as well as Index I, should be on the shelves of every library of importance, it is suggested that the members keep this matter in mind with a view to placing additional copies.

Association Statement

Balance in Treasury, December 1, 1920		$1176.49
By amount received for dues, 1921		740.00
By amount received from Malden National Bank—Interest.		14.04
By amount received from $100 Liberty Bond		4.25
By amount received from Journal fund		100.00
By amount received from Employment Bureau		22.33
Paid stenographic report, 1920 meeting	$143.25	
Postage	75.63	
Programs	78.95	
Supplies and stationary	44.65	
Telegraph and Express	1.27	
Returned checks	2.00	
Expenses, Pacific Slope Branch	7.56	
Clerical Work, Secretary's Office	50.00	
One-half Salary Secretary	50.00	
Transfer to Index Fund	550.00	
	$1003.31	
Balance, December 2, 1921	1053.80	
	$2057.11	$2057.11
Balance Deposited as follows:		
Melrose Savings Bank	$ 179.83	
First National Bank of Malden	873.97	

Journal Statement

Balance in Treasury, December 1, 1920		$ 385.10
Amount received from subscriptions, advertising, etc.		3139.64
Amount received from Malden National Bank—Interest		16.06
Amount received from refund on Insurance		10.20
Paid for postage	$ 65.91	
Paid for insurance	17.00	
Paid for printing	$1603.21	
Half-tones	91.09	
Returned on subscriptions	9.13	
Returned checks	65.50	

Miscellaneous printing and supplies	16.56	
Telegraph and Express	3.57	
Transfer to Association Fund	100.00	
Salary of Editor	100.00	
Clerical work, Editor's office	65.00	
One-half Salary of Secretary	50.00	
Clerical work, Secretary's Office	40.00	
	$2226.97	
Balance, December 2, 1921	1324.03	
	$3551.00	$3551.00
Deposited in First National Bank, Malden, Mass.	1324.03	
The JOURNAL Owes the Association account		250.00

INDEX I STATEMENT

Balance in Treasury, December 1, 1920		$ 74.84
Received from sales		180.50
Received from return on Insurance		1.70
Paid for postage	$ 5.35	
Returned check	5.00	
Transfer to Index II	100.00	
	$ 110.35	
Balance, December 2, 1921	146.69	
	$ 257.04	$ 257.04
Balance deposited in First National Bank, Malden, Mass.	$ 146.69	

INDEX II STATEMENT

Balance in Treasury, December 1, 1920		$ 766.15
Received from sales		825 12
Received from loans		1400.00
Received from interest		15.00
Paid for printing Index and 500 cartons	$2094.77	
Paid for notices and envelopes	7.74	
Paid for editing expenses	175.00	
Postage	30.06	
Express and Freight	4.87	
Cancelled Orders	10.00	
Returned check	5.00	
Repayment of Loans	650.00	
	$2977.44	
Balance, December 2, 1921	28.83	
	$3006.27	$3006.27

Deposited in First National Bank, Malden, Mass.		28.83
Index II owes Association account	$ 550.00	
Index II owes Index I		100.00
Index II owes four notes		100.00
Total indebtedness		$ 750.00

SUMMARY

Balance in Index I account	$ 146.69
Balance in Index II account	28.83
Balance in JOURNAL account	1324.03
Balance in ASSOCIATION account	1053.80
One 4¼ Liberty Bond	100.00
	$2653.35

Respectfully submitted,
A. F. BURGESS, *Secretary.*

Voted that the report be accepted and the financial portion referred to the Auditing Committee.

PRESIDENT GEORGE A. DEAN: The next in order is the report of the Executive Committee.

REPORT OF THE EXECUTIVE COMMITTEE

The Executive Committee has held no meetings during the year.

Requests have been received to arrange for joint sessions, from Section O on Agriculture and Section N on Medical Sciences, of the American Association for the Advancement of Science, at the Toronto meeting. Owing to the crowded nature of our program and that arrangements had already been made for two joint sessions, it did not seem practical to make arrangements for further joint sessions at this time.

The Executive Committee recommends:

That in order to expedite the business of the Association, hereafter the auditing of the accounts be made by the Executive Committee prior to the opening of the annual meeting.

That the books be kept so as to indicate the receipts and expenditures for each activity, as is now the practice.

That every activity of the Association should be self-supporting.

That a permanent fund be established, to which may be transferred each year a portion of the unexpended balance not required for current expenses, such amount to be decided by the Executive Committee.

Signed—
GEORGE A. DEAN
ARTHUR GIBSON
A. G. RUGGLES
A. F. BURGESS
Committee

Voted that the report be accepted and the recommendations adopted.

PRESIDENT GEORGE A. DEAN: We will now listen to the report of the Representative to the National Research Council, which will be presented by Mr. J. P. Parrott.

REPORT OF REPRESENTATIVE TO THE NATIONAL RESEARCH COUNCIL

The annual meeting of the Division of Biology and Agriculture for the election of officers for the ensuing year was held on April 22 at the headquarters of the National Research Council. Dr. L. R. Jones of the University of Wisconsin was elected chairman of the Division, and your representative was re-elected a member of the executive committee. Subsequent meetings were held at Woods Hole, Mass., on June 23 and at the offices of the Research Council on November 18, which comprise all of the regular sessions of the executive committee during the year.

Up to this time, the National Research Council, as an organized force for the promotion of research, has largely been occupied with laying foundations, with systematizing and developing its machinery, with formulating principles of procedure to secure contacts with individuals and groups of individuals representing science and industry, and with encouraging and organizing various constructive forces which make for greater research power and output. It has, therefore, been largely a period of plans and expectations rather than of achievement.

During this year, I am glad to report, the activities of the Division of Biology and Agriculture denote more of accomplishment and less of organization, and unless signs fail this will continue in an increasing degree with advancing years. Space prevents an enumeration of all the definite accomplishments of the Council or more particularly the Division of Biology and Agriculture. But for the sake of interest which naturally inheres in the efforts of this insitution, a few examples may be noted which illustrate the range of activities and aid extended to meet various needs, viz.— A site has been purchased for the erection of a building, and the preparation of plans for a structure of great architectural beauty and practical utility, is now underway. A fund of $500,000 has been raised for the support of fellowships in chemistry and physics. The Southern Pine Association appropriated $10,000 for the use of the committee on forestry in organizing and maintaining certain forestry researches which are now in progress. Pledges have been made for the support of special investigations on food products. Various sums of money have been secured for the maintenance of Botanical Abstracts and certain biological journals. Support has been found for the Concilium Bibliographicum. By the aid of a special grant plans are now being made for substantial additions to the facilities of the Marine Biological Laboratory, with special reference to biochemistry and biophysics. Less tangible, perhaps, but a no less important achievement of the Research Council, is the development of good will and sympathetic understanding among the various groups of scientific workers and a greater appreciation of the opportunities for larger service thru coöperative endeavor.

Relative to its efforts in behalf of Entomology, we are indebted to the Division of Biology and Agriculture for assistance in a coöperative project, supported by a number of phytopathologists and entomologists of the north-eastern apple growing section, to determine the merits of dusting for the control of injurious insects and plant diseases. Mention was made of this undertaking as well as the summer meeting of interested workers in the August number of the JOURNAL OF ECONOMIC ENTOMOLOGY. The details of the experiments and principal results will be presented in the second number of the *Digest* of the Crop Protection Institute. Great good

develops from such undertakings, and similar efforts should be encouraged in other areas of the country as they mold public sentiment and provide opportunities for the exchange of ideas and advantageous consulatation.

Thru the assistance of the Division of Research Extension, the writer met the members of the executive committee of the Division of Chemistry to secure financial support for investigations of certain insecticides. It is clear that fellowships are available for such studies, and Dr. William Moore is preparing an application for a fellowship for an investigation of the insecticidal properties of sulfur. An outline of a project, providing for a study of the fungicidal and insecticidal properties of sulfur, as influenced by temperature and moisture, is being prepared by a committee, representing the phytopathologists and entomologists. It is hoped that this investigation will be financed by three leading concerns engaged in the mining of sulfur, two of which have expressed their approval of the project and intentions to contribute funds. Application has also been made to the Synthetic Organic Chemical Association for the support of an investigation to determine methods of preparing synthetic nicotine or a satisfactory substitute for the tobacco preparations used by the agricultural industry.

As pointed out last year, it is largely the task of the different scientific societies to secure funds for their individual projects. Consideration should be given to the problem of increasing our financial resources and methods for specific approach to sources of money. In this connection it should also be noted that the Research Council is encouraging various national scientific societies to compile a list, showing the number, nature and relative importance of problems that await investigation. A statement of projects of outstanding importance would prove of inestimable value in formulating an effective and consistent policy as regards research fellowships and the subsidizing of experiments and investigations.

A final word. Since representatives of the scientific societies are elected for three years and my term of office soon expires I wish to express my grateful acknowledgment of the honor of representing this association in the Division of Biology and Agriculture of the Council. Thru its inspirational forces and motive power, the National Research Council is a source of stimulation and guidance in behalf of biological research. It is the duty of entomologists to discover and utilize the opportunities and facilities afforded for the realization of their aims.

PERCIVAL J. PARROTT

Voted that the report be adopted.

PRESIDENT GEORGE A. DEAN: The report of the Trustees of the Crop Protection Institute will be presented by Professor W. C. O'Kane. [This was given as a paper read at a later session. Ed.]

PRESIDENT GEORGE A. DEAN: The next report is that of the Committee on Nomenclature, by Edith M. Patch.

REPORT OF THE COMMITTEE ON NOMENCLATURE

A list of approximately 700 common names of insects is before the committee on nomenclature for consideration. These with the approximately 300 names already accepted by the Association will total 1000.

It is the plan of the committee to submit this list in whole or in part to certain entomologists experienced in editorial work and to solicit suggestions from those who have previously served on this committee and are therefore in touch with the problems

concerned. The aid of specialists will be asked in editing the scientific names of the respective orders. It is then proposed to revise the list with reference to solicited suggestions and to present it in multigraph form to the members of the Association at the next annual meeting.

On account of its length, action by the Association can hardly be taken at that meeting; but members will be welcome to retain copies and to submit to the chairman of the committee, on or before March 1, 1923, objections to any name on the list or suggestions with reference to the list. Names against which no objecting vote is registered by March 1, 1923 will be considered accepted by the Association and printed together with the 326 names which had been accepted up to and including the St. Louis meeting.

Such is the program scheduled by the committee. Suggestions relative to this will of course be welcome at this meeting.

Respectfully submitted.

EDITH M. PATCH
Z. P. METCALF
ARTHUR GIBSON
Committee

Voted that the report be accepted as read.

PRESIDENT GEORGE A. DEAN: The report of the Committee on Index of Economic Entomology will be given by E. P. Felt.

REPORT OF THE COMMITTEE ON THE PUBLICATION OF THE INDEX OF AMERICAN ECONOMIC ENTOMOLOGY

Your Committee has functioned during the past year in an advisory capacity in connection with the editing and publishing of Index II, issued last May. The great bulk of the manuscript necessitated considerable reduction and the policy adopted in connection therewith and the reasons therefore, were approved by this Committee and are given in some detail in the introduction to Index II.

The Report of the Secretary gives the financial details, really outside the province of the Committee and these need not be repeated, though it should be noted that the outcome is in substantial accord with expectations at the time the preparation of the Index was undertaken.

Inasmuch as the Secretary's Report shows a favorable balance to the credit of Index I and in due course of time a similar condition may exist in relation to Index II, it is suggested that eventually such assets be set aside as a reserve fund which may be used for financing subsequent Indexes.

It is the opinion of the Committee, that both Indexes I and II have amply justified themselves and in view of the importance of such aids to active workers, it is recommended that the Committee be continued and directed to carefully study the situation in order to ascertain possibilities for more frequent publication of such Indexes, either by this Association or through some other agency.

Respectfully submitted,

E. P. FELT
A. F. BURGESS
W. C. O'KANE
W. E. BRITTON
W. E. HINDS
Committee

Voted that the report be accepted.

PRESIDENT GEORGE A. DEAN: We will now have the report of the Committee on the U. S. National Museum, by J. J. Davis.

REPORT OF COMMITTEE ON NATIONAL MUSEUM

Your Committee begs leave to report that during the past year there has seemed to be no particular opening for activities in addition to the measures which were inaugurated last year. The conditions with reference to the collections of insects have not been changed and it is desirable that every effort should be made to secure additional space suitable for the development of the collections, and to provide for additional curatorial service as rapidly as possible. The collections are increasing in quantity and value, and there should be every possible encouragement to entomologists throughout the country to deposit material that may be of service in their extension. Especially is it desirable that type material should be respresented in this museum as extensively as possible.

The museum has, during the past year, utilized the services of certain specialists in the re-arrangement and the study of certain groups, and this policy would seem well worth continuation. There certainly must be a more general interest, throughout the country, in the growth of the national collections and there should be a national pride in making them as extensive and useful as possible. It is very much to be hoped that in the near future it may be possible to secure adequate room for expansion, and statements concerning this need may very properly be made by individuals to any official who may be in a position to assist in this direction.

Respectfully submitted
J. J. DAVIS
W. J. HOLLAND
V. L. KELLOGG
E. P. FELT
HERBERT OSBORN
Committee

Voted that the report be accepted.

PRESIDENT GEORGE A. DEAN: The Chair will appoint the following committees:

Auditing Committee:	Glenn W. Herrick, S. B. Fracker.
Resolutions Committee:	J. J. Davis, M. C. Tanquary, L. Caesar.
Nominations Committee:	C. L. Metcalf, Arthur Gibson, George G. Ainslie.

Under the head of miscellaneous business, the Secretary announced that difficulty had been experienced in securing the programs for the meeting, and in all probability only mimeographed copies would be available; that $100 had been received from sales of Index II since the

books closed December 2d, and that all outstanding notes against the association had now been paid; that the balance on the JOURNAL account was abnormally large this year on account of delay in receiving bills from the printer, and that after these were paid, the balance would be a little less than the normal amount; and that a group photograph would be taken as soon as the session adjourned.

MR. J. J. DAVIS stated that he had been preparing for some time an entomologist's hand-book which would contain information concerning methods of rearing and handling insects, types of breeding cages, formulae for preserving material, etc., and requested contributions from all entomologists for which credit would be given.

MR. LEONARD HASEMAN stated that on account of shortage of funds, it had been impossible to reprint the reports of C. V. Riley.

PRESIDENT GEORGE A. DEAN: We will now have the report of the Committee on Policy.

REPORT OF THE COMMITTEE ON POLICY

The Committee on Policy Organized for the Current Year with the Following Sub-Committees:

EDUCATION—Dr. Ball, Chairman, Dr. Osborn, Mr. Burgess.
INSECT CONTROL—Dr. Felt, Chairman, Mr. Dean, Mr. O'Kane.
ORGANIZATION—Mr. O'Kane, Chairman, Mr. Dean, Mr. Newell.
RESEARCH—Mr. Parrott, Chairman, Dr. Ball, Dr. Osborn.
PUBLICATION—Mr. Burgess, Chairman, Dr. Felt, Dr. Pierce.

The Committee endorses the establishment of working relations between Universities or Colleges on the one hand, and the Bureau of Entomology or Experiment Stations, on the other, to bring about the graduate crediting of Research Work, done under conditions which are equivalent to those of a scholastic department, as a means of encouraging more extended preparation, and the taking of advanced degrees in Entomology.

The Committee recommends that a symposium be held in next year's program on the subject of standards for the training of men who are to enter professional entomology.

The Committee recommends that the entomologists concerned in the European Corn Borer work consider coöperation in large scale demonstrations of practicable agricultural measures in the area most badly infested by the Borer, for the purpose of securing full data on the value of various repressive measures under typical agricultural conditions.

The Insect Pest Survey work is commended. A moderate extension of the work is endorsed and greater coöperation upon the part of all collaborators is urged.

The Committee wishes to emphasize the ultimate economy of liberal appropriations for the control of recently introduced pests and for the prosecution of fundamental research in all phases of insect control.

In order to faciliate the work of councilors representing this Association with the American Association for the Advancement of Science, the Committee recommends that the Nominating Committee consider retaining councilors in office for consec-

utive years, so long as a given councilor finds it possible to attend regularly the meetings of the council. Prior to the Annual Meeting it is suggested that the President of this Association ascertain whether councilors expect to be in attendance and that the President designate an alternate in case a councilor will be unable to attend.

The Committee wishes to point out that there is a serious need of adequate funds to establish various investigational projects in entomology. It wishes to urge on all individual members the desirability of giving earnest consideration to the problem of discovering sources of such funds. It suggests that members communicate to the Sub-Committee on Research outlines of projects that should be undertaken and suggestions as to possible sources of funds. For the purpose of correlating all such activities the Committee on Policy has designated the Sub-committee on Research as the central body to which any suggestions should be sent and through which coöperation may be sought of the National Research Council, the Crop Protection Institute or other available organization.

The Committee desires to emphasize the urgent need of adequate publication funds for research.

The Committee has set about preparation of a program of research on insects of special economic importance, on materials with insecticidal properties and on possible phases of biological control, emphasizing especially fundamental problems and gaps in present knowledge to the end that a list of projects of outstanding importance may be formulated.

The Committee recommends to the Association that hereafter applications for membership shall be accompanied by a check for the first year's dues and for subscription to the JOURNAL.

The Committee recommends that permission be granted the Editorial Board of the Journal to designate a Circulation Agent.

The Committee recommends adoption of the following Resolutions proposed by a Conference called by the National Research Council, Division of Biology and Agriculture:

Resolved

1. That it is the sense of this conference that an inter-society conference should be raised to study and report upon the feasibility of federation of the biological societies and to develop plans for the said federation.

2. That for the purpose of effecting such an organization, each society, and Sections F & G of the American Association for the Advancement of Science be requested to designate its President and Secretary as members of an inter-society council which shall be authorized (1) to deal with all matters of common interest such as pooling of programs that are consistent with the existing regulations of the constituent societies; and (2) to draw up proposals for a constitution and by-laws of a federation of the societies in question, and to present them for action at the next annual meeting.

Although no formal action was taken, it was understood that the conference raised by the adhering societies should be empowered to invite other organizations to join it later.

MR. W. C. O'KANE: This report involves consideration by the Association of several specific recommendations. I will read them one at a time for action by the Association.

First, the Committee recommends that a symposium be held in next year's program on the subject of "Standards for the Training of Men Who are to enter Professional Entomology."

Voted that this recommendation be adopted.

Second, the Committee recommends that hereafter applications for

membership shall be accompanied by a check for the first year's dues and for subscription to the JOURNAL.

Voted that the recommendation be adopted.

Third, The Committee recommends that permission be granted the Editorial Board of the JOURNAL to designate a circulation agent.

MR. GLENN W. HERRICK: What does the Committee mean by "circulation agent?"

MR. W. C. O'KANE: There are doubtless many libraries and individuals who would like to subscribe for the JOURNAL, and the idea is for the Editorial Board to find some member who is willing to give some time to correspondence and act as a circulation agent for the JOURNAL with the intent of enlisting the help of the various entomologists to secure additional subscriptions. This agent would, of course, serve without pay.

MR. E. P. FELT: The JOURNALl can be furnished to additional subscribers at very small cost to the management, and the amount secured will enable the JOURNAL to publish more matter.

MR. W. C. O'KANE: One hundred additional subscriptions would make a difference in the financial status of the JOURNAL at the end of the year, and two or three hundred would possibly mean a larger JOURNAL. It is necessary to follow this matter up closely if the subscription list is to be increased.

MR. GLENN W. HERRICK: What proportion of our membership subscribes to the JOURNAL?

SECRETARY A. F. BURGESS: About 80% of the members are subscribers.

Voted that the recommendation be adopted.

Fourth, the Committee recommends the adoption of the resolution proposed by the conference called by the Division of Biology of the National Research Council, authorizing our President and Secretary to represent us at a conference which will attempt to draw up plans for a federation of biological societies.

MR. T. J. HEADLEE: May I ask for a statement of the anticipated advantages of such an organization?

PRESIDENT GEORGE A. DEAN: Is our representative on the National Research Council here?

MR. P. J. PARROTT: We believe there are some important matters of great interest to all scientific workers that cannot be handled by the individual societies. European work is greatly demoralized on account of finances. One of the objects sought to accomplish is to obtain money by which American Zoologists and Biologists would control their own literature. By an organization of this character, it is hoped to arrange in advance of the annual meetings for a conference of the

Secretaries of the Societies to avoid conflicts in programs and arrange symposiums which are of interest to all. These are the principal items. We are asked to send representatives to this conference to see if we cannot make arrangements along these lines. It does not bind us to anything.

Voted that the recommendation be adopted.

The report of the Committee on Policy was then adopted as a whole.

PRESIDENT GEORGE A. DEAN: Mr. Ball has a cablegram from Holland which I will ask him to read at this time.

MR. E. D. BALL: The following cablegram has been received from Holland addressed to the plant pathologists: "If American and Canadian Plant Pathologists and Entomologists be invited to join trip to Holland and conference, Wageningen, May, 1922, will some of them come? Please cable if possible. Merry Christmas."

"(Signed) QUANJER,
VANPOETEREN,
WESTERDYK."

This is an invitation to an international meeting in Holland. It will probably be a potato conference, as these three men are especially interested in potatoes. It may be possible for the government to send one man over at that time.

FINAL BUSINESS

The final business was transacted Saturday afternoon, December 31st.

PRESIDENT GEORGE A. DEAN: The first item is the report of the Auditing Committee.

REPORT OF THE AUDITING COMMITTEE

Toronto, Canada
Dec. 31, 1921.

The Committee has examined the books and vouchers of the secretary and have found them to be correct.

GLENN W. HERRICK
S. B. FRACKER
Committee

Voted that the report be accepted.

PRESIDENT GEORGE A. DEAN: Next is the report of the Committee on Resolutions.

REPORT OF COMMITTEE ON RESOLUTIONS

1. *Resolved*, That the American Association of Economic Entomologists heartily endorse the Insect Pest Survey and express its deep appreciation of the facilities

furnished by the United States Bureau of Entomology and the excellent services of J. A. Hyslop in organizing and conducting the initial work.

It is our opinion that the Insect Pest Survey is of great economic importance to present day and future entomology and that it is not only a privilege but the duty of every entomologist to coöperate with the observers responsible for the individual state reports and that the state reporters should realize the double responsibility placed upon them and that each one should make his reports complete and submit them promptly.

We would urge that the Insect Pest Survey be furnished expert assistance and that those responsible for its development further investigate the uses and needs of this service to the end that the correlation and interpretation of the data thus secured may be used in a study of the underlying principles involved in periodic or spasmodic insect outbreaks.

In view of the permanent value of the annual Insect Pest Survey summaries, it is strongly urged that these summaries be printed and made available.

2. *Resolved*, That this association express its appreciation of the valuable services rendered through the *Journal of Agricultural Research* and the *Experiment Station Record* and urge that funds be made available at the earliest possible date to resume publication of these two Journals.

3. *Resolved*, That the American Association of Economic Entomologists urge further and more complete coöperation between the Federal and state entomologists, between entomologists in neighboring states and between those of the United States and Canada, as suggested so clearly and forcibly by President Dean in his annual address.

4. *Resolved*, That it is the sense of this association that further and more extensive studies on insecticides and fungicides are needed and that in this connection it is highly important that chemists who can give their entire time to the chemistry of insecticides and fungicides be employed to work in coöperation with entomologists and pathologists.

5. *Resolved*, That, inasmuch as the literature dealing with insect pests of greenhouse and flower garden plants is widely scattered and that there is need of gathering together this information for use of florists and entomologists, and further that since such a compilation will, we believe, directly stimulate the study of greenhouse insect pests and in this way be of additional value to American florists, that this association indorse the Greenhouse Insect Index (prepared by J. J. Davis) and suggest that the Society of American Florists undertake its publication.

6. It is recommended that the President of our Association appoint the Committee on Resolutions at least a month previous to the date of meeting in order that a more careful study and organization of the problems to be considered by that committee may be made.

7. *Resolved*, That the American Association of Economic Entomologists express its great thanks and appreciation to the authorities of the University of Toronto, the Royal Canadian Institute and the Provinical Government of Ontario for the opportunity of holding its meetings at the University and also for other privileges and entertainment enjoyed through their courtesy.

Respectfully submitted,

JOHN J. DAVIS,
M. C. TANQUARY,
L. CAESAR.

Committee.

After slight changes had been made in phraseology at the suggestion

of Dr. Howard and W. C. O'Kane, the resolutions were adopted by vote of the association.

PRESIDENT GEORGE A. DEAN: We will now hear the report of the Committee on Membership.

REPORT OF COMMITTEE ON MEMBERSHIP

The committee on membership submits the following report, and recommends for election to associate membership·

Batchelder, Charles Howard, 38 N. Main St., Orono, Maine
Bedford, Theo., Wellcome Tropical Research Laboratories, Khartoum, Sudan
Borodin, Demetrius N., Room 1009, 709 Sixth Ave., New York City.
Brannon, Clarence, H., Greenville, Miss.
Bradley, George H., Mound Laboratory, Mound, La.
Broadbent, Bessie M., 1812 Ingleside Terrace, Washington, D. C.
Butcher, Fred D., Ames, Iowa.
Compton, C. S., Natural History Building, Urbana, Ill.
Dodds, Clifford T., 2344 Eunice St., Berkeley, Calif.
Doucette, Charles Felix, Doylestown, Pa.
Douglass, James R., 6427 First Ave., Birmingham, Ala.
Downes, W., Dominion Entomological Laboratory, Victoria, B. C.
Dye, H. W., Bailey Hall, Ithaca, N. Y.
English, Lester L., 6427 First Ave., Birmingham, Ala.
Harwood, R. W., Natural History Building Urbana, Ill.
Hoke, Gladys, Agricultural College, Miss.
Frison, Theodore Henry, Box 69, Riverton, N. J.
Glick, Perry A., 605 E. Daniel St., Champaign, Ill.
Griswold, Grace Hall, 126 Roberts Place, Ithaca, N. Y.
Hambleton, James T., 423 Dorset Ave., Chevy Chase, Washington, D. C.
Horton, Harvey A., Eagle Pass, Texas.
Keler, Stefan, Lemberg, Tarnowskiego 45, Poland.
Lancaster, Herman B., 6427 First Ave., Birmingham, Ala.
Lowry, Philip R., Durham, N. H.
McEvilly, J. E., Box 1, Agricultural College, Miss.
Mote, Don. C., Box 348, Phoenix, Ariz.
Nolan, Willis J., 423 Dorset Ave., Chevy Chase, Washington, D. C.
Pack, Herbert J., Utah Agricultural College, Logan, Utah.
Phipps, Clarence R., Experiment Station, Mountain Grove, Mo.
Readeo, Phillip, Lawrence, Kan.
Riley, George E., Agricultural College, Miss.
Smith, George E., Albion, N. Y.
Spessard, Lester Lewis, 1624 P St., N. W. Washington, D. C.
Thomas, C. A., Bustleton, Pa.
Watson, J. R., Gainesville, Fla.
Worthley, Harlan N., Dept. of Entomology, M. A. C., Amherst, Mass,

For transfer from associate to active membership:

Ackerman, A. J.
Barber, G. W.
Beyer, A. H.
Bilsing, S. W.
De Ong, E. R.
Dusham, E. H.
Graham, Samuel A.
Guyton, Thomas L.
Hartzell, Albert
Kisliuk, Jr., Max

Morse, A. P.
Poos, F. W.
Smith, Roger C.
Snapp, Oliver I.
Stear, J. R.
Thomas, Frank L.
Turner, William F.
Wade, Joe S.
Worthley, L. H.

The committee recommends that the resignation of the following members be accepted:

Bailey, J. W.
Blakeslee, E. B.
Cushman, R. A.
Gray, George P
Ham, W. T.
Rane, F. W.
Schalck, E. N.
Wood, E. G.

and that the 9 active and 17 associate members who are in arrears for dues for two years and the 10 members elected last year who have paid no dues, be notified by the Secretary that if the amount due the association is not paid within 60 days from the date of notice that they will be dropped from the roll for non-payment of dues.

Respectfully submitted,
E. R. SASSCER,
A. G. RUGGLES,
J. S. HOUSER.
Committee

Voted that the report be accepted and the recommendations adopted.

PRESIDENT GEORGE A. DEAN: Are there other reports?

DR. L. O. HOWARD: I wish to present the report of the Advisory Committee for the JOURNAL.

REPORT OF ADVISORY COMMITTEE

The members of the JOURNAL Advisory Committee in attendance today, met and unanimously recommend for officers of the JOURNAL

Dr. E. P. Felt, as Editor
Dr. W. E. Britton, as Associate Editor
Mr. A. F. Burgess, as Business Manager

R. W. HARNED
H. A. GOSSARD
L. O. HOWARD

Voted that the men nominated by the Advisory Committee be elected officers of the JOURNAL.

PRESIDENT GEORGE A. DEAN: We will now hear the report of the Committee on Nominations.

REPORT OF THE NOMINATING COMMITTEE

For President, J. G. Sanders.
First Vice-President, J. M. Swaine.
Second Vice-President, A. L. Lovett.
Third Vice-President, R. W. Harned.
Fourth Vice-President, M. C. Tanquary.
Committee on Policy, P. J. Parrott.

Committee on Membership, George G. Ainslie.
Committee on U. S. National Museum, E. P. Felt.
Representative National Research Council, George A. Dean.
Councillors for American Association for the Advancement of Science, T. J. Headlee, L. O. Howard.
Trustee Crop Protection Institute, W. E. Britton.
Advisory Committee, Arthur Gibson, R. A. Cooley.

Respectfully submitted,
ARTHUR GIBSON,
GEORGE G. AINSLIE,
C. L. METCALF.
Committee.

Voted that the report be accepted and the Secretary be instructed to cast one ballot for each nominee. The ballots were cast and the members named were declared elected. At the request of President Dean, Past Presidents Howard and Osborn conducted President-elect Sanders to the Chair.

After signing a Past President diploma and presenting it to President Dean, President-elect Sanders addressed the association, expressing his appreciation of the honor that had been conferred upon him and pledging his best efforts to the association for the coming year.

President Dean presented to President-elect Sanders the gavel of the association to be placed in his keeping for the coming year.

Secretary Burgess stated that he had held a conference with the officers of the American Phytopathological Society and arrangements had been made to hold a joint session next year. The subject to be discussed had not been decided, but it was requested that the members of each association send any suggestion they might have along this line to the Secretary of their Association. This should be done as soon as possible, as speakers should be selected by the first of April in order that they might have ample time to prepare their papers for the meeting.

He also read the following communication in regard to extension work which was signed by E. G. Kelly and W. P. Flint:

"A meeting of members of this association interested in extension work was held at the Prince George Hotel the evening of Dec. 29, 1921.

After a general discussion of subjects pertaining to extension work, an informal organization was formed for the purpose of holding an annual conference in connection with the meeting of the American Association of Economic Entomologists."

Announcement of the conference will be made during the first session of the meeting at Boston.

Mr. E. P. FELT stated that the matter of handling the manuscripts submitted to the JOURNAL was becoming increasingly difficult, particularly on account of the fact that many publications handling short papers had been or were being discontinued. He presented the following statement which had been reviewed and had the endorsement of both the Advisory and Editorial Boards of the JOURNAL.

JOURNAL OF ECONOMIC ENTOMOLOGY SUMMARY

Membership of Association 667, of which 49 are foreign.

Number of subscribers, 896.

Average cost per page of printing JOURNAL in 1914, $2.24, in 1920, $4.79, in 1921, about 10% higher than last year.

January 1, 1920, the subscription price was increased by $1.00, or 66⅔% for members and 40% for non members.

The increased cost of publication since 1915 amounts to over 114%.

The JOURNAL is the official organ of the Association and as such should serve the best interests of the entire membership. The official proceedings rightly have precedence. The inclusion in the official proceedings of papers read by title gives them precedence over others, sometimes more important ones, which may have been in the hands of the editor months earlier. Papers read by title now occupy a considerable part of the proceedings.

The constant increase in the volume of the matter submitted for publication has necessitated progressive restrictions to keep within our means. It is essentially a financial problem. Authors have been advised from time to time that contributions were too lengthy for available space and at our last meeting a maximum limit of 2500 words was established for the purpose of giving a better opportunity for the independently submitted manuscript. Even this does not make it possible to print one such paper annually from each member, a total, if this were done, of 3000 pages as compared with the usual 500 or less

There have been submitted to the editor within the last few years, papers which would make nearly 20 printed pages, sometimes with considerable tabular matter or a rather large series of illustrations—both much more costly than ordinary text.

It is impossible to print all papers which may be offered unless resources are greatly increased, possibly seven to ten fold and even then restrictions would be necessary. Many other scientific publications are in about the same predicament. High prices and unusual limitations in many directions explain the situation.

Additional funds may be secured by increasing the subscription rate, getting more subscribers or securing funds from some outside agency.

A raise in the price of the JOURNAL may be offset in large measure by a reduction in the number of subscribers. It could not become effective until 1923.

In spite of the technical nature of the JOURNAL it is possible to considerably increase the number of subscribers, each additional subscription increases actual cost about 20% and permits the turning back into the JOURNAL of about 80%.

Outside sources are more easily discussed than discovered. Most feel that the JOURNAL should be self supporting. It has been the Association method of doing business.

Increases in the advertising matter would assist materially and might bring some most unwelcome complications. The limited circulation and the few direct sales resulting are obstacles not easily overcome.

The managers of the JOURNAL keenly appreciate the need of larger publication facilities and would welcome suggestions for bettering conditions. It is felt that the worst has passed. A gradual change for the better is expected soon.

In view of the above, it is considered advisable to limit the official proceedings to papers actually read at the meetings, to allow the length of papers to remain at a maximum of 2500 words, to suggest to authors continued conciseness in text and careful discrimination in the use of the more costly tables and illustrations, and to urge upon every member and well wisher of economic entomology a general and

earnest effort to increase the number of subscribers and thus secure at once more funds which will be used to enlarge the JOURNAL and then it in turn can render better service to its widely distributed subscribers.

Voted that the statement be accepted and the recommendations contained therein be adopted.

Mr. T. J. HEADLEE inquired as to the cost per page of printing the JOURNAL, and upon being advised that it averaged about $5.00 provided very little tabular matter was used, stated that he believed it would be practical to publish papers from individuals or institutions provided they were willing to pay the cost, they to receive a certain number of separates. He thought this would offer an opportunity for publishing more matter in the JOURNAL.

Mr. E. P. FELT stated that the management had never refused to publish a paper if the author wished to pay the cost, but felt that care should be taken not to discriminate against any member by compelling him to make payment. He expressed his approval of the idea suggested by Dr. Headlee.

Mr. W. C. O'KANE stated that many institutions with which entomologists were connected were financially able to pay for the publication of short articles, and he believed that they be urged to do so.

Mr. E. P. FELT stated that if articles were paid for, they could be printed with less delay, and Mr. OSBORN suggested that the Editor should have authority to exercise his judgment as to whether a paper was suitable regardless of whether it was to be paid for or not.

Mr. T. J. HEADLEE stated that the plan should be handled so as to avoid any suspicion of discrimination among the members.

Mr. Z. P. METCALF believed that there were a good many cases where either the authors or the institution with which they are connected would be very willing to pay for publishing short articles, and that he was satisfied that they could be published cheaper than if issued separately.

Mr. L. M. PEAIRS remarked that the institution should pay a definite amount for separates which would cover the cost of both publication in the JOURNAL and the separates. This would simplify bookkeeping and would, he believed, cost the stations less than they were now paying for small publications.

In reply to a question by Mr. T. H. Parks as to whether a 2500 word limit would be enforced if an institution paid the cost of publication, Mr. FELT stated that he saw no advantage in enforcing the rule in a case of this kind, or in the case of a member who preferred to pay for matter overrunning the present maximum if reasonable limits were observed.

It was voted that the early publication of articles approved by the Editor be permitted, if the cost is paid by the writer or institution with

which he is connected, and that men contributing papers to the JOURNAL be urged to secure permission when possible to publish articles under these conditions.

PRESIDENT GEORGE A. DEAN: The Executive Committee has authorized the Secretary to transfer the $100 Liberty Bond and $500 from the association fund to the permanent fund.

Is there any other business?

SECRETARY A. F. BURGESS: I move that the next meeting of the association be held at the same time and place as that of the American Association for the Advancement of Science.

The motion was carried.

DR. L. O. HOWARD: The next meeting of the association will be in Boston, followed by a meeting in Cincinnati and Washington. After that, there will probably be a meeting in the West, but the place has not been definitely decided.

SECRETARY A. F. BURGESS stated that as Christmas would come on Monday in 1922, it would be more difficult than usual to arrange the program. He stated that he had had a conference with the Secretary of the Entomological Society of America and a plan was being considered of holding one session of the meeting of that society during the time when one of the sessions of the association was being carried on. Of course, the programs would have to be arranged so that unrelated subjects would be considered at these sessions. The suggestion was made in order to see how a plan of this sort would work out. No objections being offered, attempt will be made to put it into operation.

Mr. WILLIAM MOORE suggested that less than 50% of the members were present at the business session, and that it would seem desirable to change the business meeting to the morning instead of the afternoon session on the last day of meeting.

SECRETARY A. F. BURGESS stated that the by-laws provided that the final business shall be transacted at the last session, but that the by-laws could be amended by a notice in writing prior to the time of the next annual meeting.

Mr. E. P. FELT: I would like to announce at this time that it has been decided to establish several small departments in the JOURNAL, one each for Horticultural Inspection, Apiculture, and for the Pacific Slope Branch, and possibly another department covering new insecticides, if some one can be secured to handle the matter that should be published. The idea is to increase local interest in the JOURNAL and make it more valuable to its readers. The plan will be tried in a modest way at first, and the co-operation of all is desired in order to make it a success. It is expected that the Secretaries of the Sections and of the Pacific Slope Branch will take care of the matter to be used in their departments.

PRESIDENT GEORGE A. DEAN: As this meeting draws to a close, allow me to express my appreciation of the honor you have shown me in selecting me to serve as President of the American Association of Economic Entomologists. I have deeply enjoyed whatever service I have given during the past year, and I wish to thank the members of the Association, particularly the committees, for their fine spirit of endeavor toward the accomplishment of constructive work. I cannot permit this meeting to close without expressing my heartfelt appreciation of the faithful and splendid services of our Secretary, Mr. Burgess.

Dr. L. O. HOWARD: Without addressing the Chair, I wish to propose a motion that the Association heartily thanks Professor Dean for his tactful, intelligent and very efficient administration during his term of office.

The motion was seconded and carried unanimously.

The meeting adjourned at 4.15 p.m.

ENTOMOLOGISTS' DINNER

The entomologists' dinner was held Friday, December 30, 1921, in the Banquet Hall of the Prince George Hotel, at 7.00 P. M.

President George A. Dean presided.

At the close of the dinner, President Dean introduced Dr. W. E. Britton as Toastmaster of the evening, as follows:

This splendid gathering this evening of nearly one hundred forty has certainly dispelled any doubt that may have been in the minds of the committee as to the desirability of continuing the Entomologists' dinner.

The committee has selected for toastmaster one of the past presidents of the Association, who has not only contributed much to our entomological science, but also one who has exerted a splendid influence toward the accomplishment of a fine spirit of harmony and a bond of friendship among the members of the Association. I take pleasure at this time in introducing as our toastmaster, Dr. W. E. Britton, State Entomologist of Connecticut.

TOASTMASTER W. E. BRITTON: Mr. President, Fellow Entomologists and Friends: This is an interesting meeting in a good many ways. It is a sort of anniversary of the founding of this Association, which started then in a small way and now has a membership of over six hundred. It is also an anniversary of the Entomological Society of Ontario. It is also interesting because some of us have left our native country and crossed the line to meet with neighbors. To be sure, we didn't notice the line when we crossed it, and shouldn't have known much about it except for the customs official.

Entomologists in their training and development are something like insects. They pass through certain stages. Now some of them have striking and complete transformations. With others the development goes on more slowly and takes place in an inconspicuous and obscure manner. With some we may say that the transformation is incomplete. I might go further and say that some of them never reach the adult stage. Now we have as speakers to-night quite a number who emerged as adults sometime ago. Some of you, of course, are only second stage nymphs. (Laughter)

Before we begin the program of the evening I wish to refer to that summer meeting that we had last July. We had a very interesting two days' meeting in Eastern Massachusetts, and we saw many things of entomological interest, but the one thing that stands out in my mind above all others, and will, as long as I remember anything, was the ball game that we had just before dinner. We had reached Bass Point, Nahant, where we were to spend the night. Dinner was not ready and our genial secretary came around with a baseball bat in hand. He said if he could find a ball, we would have a game. Pretty soon he came out with a tennis ball. He picked Messrs. Worthley and Headlee as being the two fat men of the party, and they had to choose sides to play the game. So Worthley chose Government men and Headlee chose State men. Now the first man who went into the box to pitch for the State men was Professor Parrott. (Applause) He is the Ty Cobb of the Entomologists. He pitched two innings I think, and then Dr. Headlee went into the box—and he was the Babe Ruth! You ought to have seen the fun that we had!

Dr. Headlee's assistant, Dr. Peterson, was the catcher, and Dr. Headlee used all the speed at his command. He was a little wild and a little out of practice, and the spectators thought at first that he was trying to kill his assistant. Very soon they thought he was trying to kill off the Government men who came to bat. I can't tell you the score, but we had a lot of fun and we have felt better for it ever since. If there is any controversy between our Canadian friends and the entomologists from the States, I think we had better settle it by playing a baseball game.

I have here a letter from Professor C. W. Hargitt written to Dr. Felt, and I wish to read it to you.

SYRACUSE, N. Y.
Dec. 22,'21

Dear Dr. Felt:

Appropos of the meetings of the Economic Entomologists at Toronto next week, and the proposed reunion of the Charter members of that Association at which I was invited by the President, Professor Dean, to make a brief talk, I regret that circumstances which have just culminated may prevent my attendance,

tho it may be possible to get there. I feel it incumbent however, to make this statement to you in order that you may communicate the reason of my absence should I fail to appear.

From the time of your first mention of plans to me last fall I looked forward with delightful anticipations to the opportunity of meeting and recounting some of the pleasantest of my scientific associations and friendships. Among entomologists were Comstock, Riley, Lintner, Bethune, Fletcher, Smith, Howard, Webster, and others whose friendship I greatly cherish.

Thanking you personally for having noted my name among those participating in the original meeting, and hoping yet that I may be able to join you at Toronto in this reunion, believe me,

Yours truly,
CHAS. W. HARGITT

Now some of you know, at least who will be one of the speakers on the program to-night, because it is a paper left over from one of the meetings, and the gentleman who is to give it needs no introduction to you. However, I am going to introduce him. I have known Dr. Howard for some twenty-five years and we have always gotten along very well together. We have nearly always agreed, but there have been a few times when we disagreed. And when he gets as many gray hairs in his head as I have, then he will see wherein he was wrong. (Laughter)

Dr. Howard has built up a large organization of entomologists, the largest in the world, I think. I never knew how he managed to do it and get along with all these fellows, but I suspect that it is because he calculates the ecological relationships between his various men, not by the slide rule but by the golden rule. Dr. Howard. (Applause)

DR. L. O. HOWARD: Dr. Britton doesn't know whether, if I had any hair, it would be gray or black or red! (Laughter) I'll tell you a secret though: When Einstein came to Washington this spring and exhibited that big head of hair, I was strongly tempted to let my hair grow again; but my wife dissuaded me!

I am right in the middle of my cigar and I feel about like Professor Bateson did at the Naturalists' Dinner last night. Bateson's cigar went out while he was making his address, and he stopped the speech until he lighted it again. One of the men met him at luncheon today, and suggested that he was hard at work on an invention whereby a man could speak and smoke at the same time. Bateson was greatly interested and said, "What an extraordinary people you are!" (Laughter)

This ought to be an occasion for joyous speech such as the Toastmaster has given you, and to take an adjourned paper from the morning session of yesterday and read it at this time would hardly seem quite right—but it is all right. There are good reasons for it. Very great things deserve treatment with circumstantiality of detail. Daniel Defoe's story of the great plague in London, and Pepys' Diary, are full of details, but they relate to an extremely interesting event and period. Now this is a paper of details, but refers to an extraordinary

organization—The Association of Economic Entomologists. This is its beginning. It grew from a little bit of a thing. Therefore these details should be interesting. Of course a great many of you are not at all interested, but after what I have just said you are obliged to be interested.

THE ORGANIZATION MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS AT TORONTO, AUGUST, 1889

By L. O. HOWARD, *Washington, D. C.*

On the 1st of November, Doctor Felt wrote me suggesting that a brief note concerning the organization of this Association could appropriately be presented at this present meeting, since the organization occurred at this place, and since in the interval of more than thirty-two years the Association has not met here.

The idea of such an association as ours was first suggested in an editorial note in *Insect Life* in January, 1889. I am not quite clear as to who wrote the note, although I judge, from certain peculiarities of construction, that it was Professor Riley. At all events, the idea of forming such an association was surely his. In this preliminary note, he asked for the opinions of different entomologists, and a month later published extracts from letters from Prof. A. J. Cook and Professor Osborn endorsing the idea. Later, letters were received from T. D. A. Cockerell and a few others.

Professor Riley went to Europe in the late spring and remained abroad until the following October, and during his absence the organization was effected.

In anticipation of the coming Toronto meeting, James Fletcher of Ottawa had been made President of the Entomological Club of the American Association for the Advancement of Science. On May 23d, I wrote Fletcher as follows:

"About the proposed entomologists union: Prof. Riley, in making the proposition, put it out as a tentative wording of an idea he had long entertained and which we have often discussed; his object being to see how the idea would be received. We have been much disappointed with the result, and if it has met with general favor most entomologists have kept their opinions to themselves in spite of the fact that we plainly asked for a general expression of opinion. The result at which I have arrived in my own mind is that on the whole the actual workers are lukewarm and that perhaps the idea has been broached too soon * * * I should like very much to see the question brought up at Toronto and thoroughly discussed and perhaps a committee appointed to draft a plan of organization."

On June 17th I wrote Fletcher again—

"I have just received a letter from Professor Riley, who is of the opinion that it will be better for you to make the call as President of the Entomological Club and to go ahead under that call and organize at the forthcoming meeting of the American Association. He thinks that it will be better to confine the association to

the working, practical economic entomologists, as there is hardly any necessity for a national association of any other kind. He suggests that when you come to Washington you and I together should draw up a constitution and by-laws and set forth the objects of the association."

The following month Fletcher came to Washington and spent some time with me. Together we drafted the original constitution as published in *Insect Life* for September, 1889, pages 87–88, and during his visit Fletcher wrote the interesting article entitled "Preliminary Note upon *Chionobas* (*Oeneis*) *macounii* Edw.," and Miss Sullivan made the excellent illustration accompanying the note, which is published on page 45 of Volume II of *Insect Life*. I myself was busy in preparing the article on a newly imported elm insect (*Gossyparia ulmi* Geoff.) published upon pages 34–41 of the same number.

It was Fletcher's first visit to Washington, and we had a delightful time together. He was enormously interested in everything—insects, trees, plants, niggers—his interest and enthusiasm were absolutely catholic. We were in the middle of the horn-fly investigation at the time, and he took a trip into Virginia with me to study this insect and experienced for the first time the July heat of Warrenton, which, however, in no way lessened his energy and enthusiasm.

Immediately after his departure I wrote to twenty-seven of the leading economic entomologists of the country, at follows:

Dear.....:—I send you enclosed a circular just issued by Mr. James Fletcher, Entomologist and Botanist of the Central Farms at Ottawa, and President of the Entomological club of the American Association for the Advancement of Science, who has just visited Washington. If you can possibly attend this meeting, I would earnestly urge you to do so, and if you cannot attend please address a letter either to Mr. Fletcher at Ottawa or to myself before August 22d giving us the benefit of your ideas and stating further, if such an association is organized, you will consent to take an active part in it hereafter.

With this letter, I enclosed a copy of the draft of the proposed constitution to Professor Forbes, to Professor Comstock, and to Doctor Lintner.

The Toronto meeting of the American Association in August, 1889, was a great success. The Entomological Club of the Association held a very interesting meeting, but the organization meeting of the Economic Entomologists was attended by only nine of us, namely Prof. A. J. Cook, who acted as Chairman, Dr. John B. Smith, who was Secretary, Dr. C. J. S. Bethune, Mr. James Fletcher, Mr. E. Baynes Reed, Mr. H. H. Lyman, Prof. C. W. Hargitt, Mr. E. P. Thompson, and the writer. The meeting was held at Scarborough Heights, a wooded knoll on the shore of Lake Ontario, the afternoon having been devoted by the zoologists and botanists of the American Association to a collecting expedition.

In my address as President of the A. E. E., delivered at Brooklyn August 14, 1894, I made a brief mention of this organization meeting

and indicated that the name adopted was *The Association of Official Economic Entomologists*, which was altered at the first annual meting, held in Washington in November of the same year, to read *The Association of Economic Entomologists*. Analyzing the official status of the men at the organization meeting, and those at the Washington meeting, and those at the Brooklyn meeting five years later, I stated that I had introduced these brief historical data in my presidential address for the purpose of showing the interesting paradox that this Association was originally made official by non-officials, that it was subsequently made non-official by officials, and that since it was made non-official it had become more official than before.

As this is simply a historical note suggested by our present place of meeting, it would hardly be appropriate to make further comments; yet I cannot refrain from stating that in the tremendous advance of economic entomology in the United States this Association has played a most important part and that its influence has been felt all over the civilized world.

What precedes was written mainly from memory, and what I have said about the organization meeting corresponds to the introduction to my address in 1894; but after this was written I consulted the account as given in the *Canadian Entomologist* for September, 1889, pages 166 to 168, and find that there was a meeting August 28th (the day before the meeting at Scarborough Heights August 29th) of a committee of organization, and that those present who signed the constitution on the 29th included, besides those mentioned (with the exception of Mr. E. P. Thompson), C. M. Weed and H. Garman. Weed and Garman were undoubtedly present the day before, but my memory fails me as to their presence on August 29th, and indeed I failed to record them when I wrote the paragraph in the presidential address in 1894, only five years after the event.

All of the persons present at the organization meeting of the Association of Economic Entomologists were readily accounted for, with the exception of E. P. Thompson. I knew about him in August 1888, but what I knew had been lost from my mind in the intervening years. For the purposes of this reminiscential sketch, it became very desirable to find out something about him. I first consulted the indices of *Insect Life*, to find if he had written anything entomological about that time, but without result. Then I consulted the Bibliography of American Entomology, no result. I then consulted the correspondence files of the Bureau of Entomology for the years 1885 to to 1890, again without result. Then I looked at the list of members of the American Association for the Advancement of Science for the year 1888, and found E. P. Thompson, of Beaver Falls, Pa., entered as

belonging to Section A (Mathematics and Astronomy). But why would a mathematician be found attending this organization meeting? In great doubt, and without any especial hope of success, I consulted the last edition of Professor Cattell's invaluable "Men of Science," and there I found "Edward Payson Thompson, Mathematician, Riverside, Calif." The very brief notice indicates that he was Professor of Mathematics at Geneva, Pa. 1880 to 1890, and of Mathematics and Chemistry, Westminster, Pa. '91 to '93. Incidentally, he was a member of the International Congress of Mathematics at Paris in 1900. Nowhere in the sketch was it indicated that he lived at Beaver Falls, Pa. in 1888; so he might or might not be the same man—probably not. Then I looked up the old United States Postal Guides, and found that Geneva, Pa., where he was teaching at that time, is in Beaver County and that mail for Geneva was to be addressed to Beaver Falls. This rendered the identification very probable, and I wrote to Professor Thompson at Riverside, and in due time received the following reply:

142 Linden Street, Riverside, Calif.
Nov. 29, '21

Professor L. O. HOWARD, Bureau of Entomology:

Dear Sir:

Your interesting note regarding the organization meeting of the Association of Economic Entomologists is at hand. The record is correct, and in one sense I just happened to join the group; and in another, I was interested in the subject, and expected to follow it up, and have always been interested in it, but have not had the opportunity to be directly connected with it. I remember with interest yourself, and Professor Hargitt, and I think Professor Smith of Rutgers, and on one of the excursions I remember a lady, perhaps Mrs. Professor Woodward, who may not have been at the organization meeting. I was then young and felt a little out of place, but my interest and expectations were real, and it is a pleasure now to look back at that and some other early experiences. My principal study was Mathematics. I am now 63. I taught Mathematics for 24 years, and then came out to California, where my chief interest is in the orange grove, where of course the subject of Economic Entomology is of considerable practical importance.

I feel proud of the success of our Society, and not ashamed of having been in at the founding of it.

Incidentally, I used to be in the church at RockIsland, Ill. of which Secretary Wallace's father was pastor, and I have a recollection of passing the house on the way to school where Professor Riley the entomologist lived.

I remember you very well, and have seen you since at some public Association meetings.

With best regards yours,
EDWARD PAYSON THOMPSON

Dr. Howard interpolated statements as follows:

(1) Here is a little incident that has never been recorded. There was a Coast and Geodetic Survey man who stayed with me one night when Fletcher was there. Well, Fletcher and I got home just at dark. We went into the kitchen to get a glass of water and found a Scutigera running around catching flies. Fletcher had never seen a Scutigera, so he took it and put it in a glass on the sideboard. Then we went into the other room and sat there. We didn't turn up the light because it was too hot.

Then Bird came in, the Coast and Geodetic Survey man. He wanted a glass of water. Well, he got hold of this tumbler containing the Scutigera, poured water into the tumbler and drank the contents—Scutigera and all. We managed to keep him from strangling! Then he took a train for the West, and I didn't see him for years. But one day he turned up in Washington, and I said to him, "Did you ever have any bad effects from that centipede?"

He said, "Well no; but look here, Howard, I spit legs for a month!" (Laughter) (2) So you see I was one of the fathers of this great, big splendid group of children. I am proud of it. They, by the way, had no scientific mothers. It is a new kind of parthenogenesis, for which Professor O'Kane has suggested the name patergenesis. (Laughter) But there have been daughters though no mothers, and some of them have distinctly arrived. Witness Dr. Edith Patch and Miss Annette Braun over there!

Thank you. (Extended applause)

TOASTMASTER W. E. BRITTON: Since those days much more attention has been paid to entomology and more people know about it than in the olden times. Even our newspapers are noticing things entomological. In the old days they used to make all manner of fun of them. Of course they do some, now. I have some clippings here. One quotes from the report of the Connecticut Agricultural Experiemnt Station. It says, "Mr. Champlain reared four hymenopterous parasites of the genus *Pezomachus* and an undescribed Buprestid beetle of the genus *Agrilus* from galls on hop hornbeam. This should be a warning to drinkers." (Laughter)

Here is another one from a newspaper far away. Some of you know that less than a year ago there was published a check-list of the insects of Connecticut. A friend of mine, a chemist who had gone from Connecticut to Minnesota, sent me a clipping from a local newspaper, headed "Boost Connecticut," which reads as follows: "Sir: There are some folks who just must air their hatreds. There is that fellow, for instance, who has recently published a 'check list of the insects of Connecticut'." (Laughter) As far as the author was concerned, it was a labor of love, and that is about all he got out of it. He never hated anybody—not even the insects. But I could not help thinking what a lot more hatred must be aired if somebody like Professor Ruggles should publish a check list of the insects of Minnesota! (Laughter)

We have with us tonight a man who has probably had more experience in training entomologists—at least he has been at it for a greater number of years—than any other man in this country. Professor Comstock began teaching in 1872. He has been at it ever since. He was Govern-

ment entomologist in the years of 1879 and 1880, returning to Cornell the following year. He has also published a number of books on butterflies and spiders and various other things.

Now, before we call on Professor Comstock I wish to say that he has trained a large number of men who have gone out to other places, and many of the men here tonight had their training under Professor Comstock. He has been very kind to come here tonight so that we can all see him, and I will ask you to stand and drink to the health of Professor Comstock.

The members arose and drank to the health of Professor Comstock. (Applause)

PROFESSOR J. H. COMSTOCK: Mr. Toastmaster, and Fellow Workers in Entomology: I feel that I have only a slight claim to this mark of appreciation from this society. A generation has come onto the stage since I stopped working especially on economic entomology and drifted off into another division of entomology, a generation that has put economic entomology into the proud place which it now holds. My withdrawal from this division of our work was not due to any loss of interest in it, nor to any lack of appreciation of its importance. It resulted merely from the fact that in the growth of our department at Ithaca it seemed advisable to have a division of labor, and I was very fortunate to be able to put the economic phase of the subject into the hands of Professor Slingerland. You will all agree with me that that was a fortunate appointment. You know the work of that brilliant worker. One of the things I cherish most is that I had a part to play in the development of that remarkable career, unfortunately so short.

Your President, when he wrote asking me to come, said that he wished me to make a short speech of a reminiscent nature. So if I reminisce you mustn't blame it entirely on the peculiarities of old people who are apt to reminisce tiresomely, but rather on your President.

I want to tell you a word about Slingerland. Slingerland was a country boy. He came from the home town of Mrs. Comstock and she was interested in him. When he came to Cornell as a freshman the insectary had just been built, and I gave him a position as janitor in it because it was necessary for him to earn his way through college. During his freshman year he attended a course of lectures on general zoology, and at the end of the course I gave a lecture on the habits of insects, a single lecture, because the following term there was to be an extended course in entomology. Slingerland told Mrs. Comstock afterwards that that night he was unable to sleep. His mind was filled with the wonders of the insect world. He decided then that he would devote himself to the study of entomology. He also told her that when he came to Cornell he did not know that a butterfly came from a cater-

pillar. Starting from that zero point of knowledge, this man with untiring energy and devotion in the short period he was able to work (I forget just how long; but I think his working period was only seventeen years) made a worldwide reputation. You are familiar with his works. In our department we have a great accumulation of unpublished painstaking notes and photographs which are still a constant source of information.

It is a bromidic remark to say that we are living in an age of great development, but nevertheless it is true, and especially true of entomology. I think that the younger members of the society, the second stage nymphs (laughter) can not appreciate what a change there has been, in the memory of some of us who are here.

I am going to tell you a personal experience. It would be difficult to-day, I think, for you to find a young person interested in nature who does not know that there is such a science as entomology. But that was not so fifty years ago. A little over fifty years ago I became interested in botany. I was at that time studying in the winter at an academy, and sailing on the Great Lakes in the summer. I carried on my study of botany on the Great Lakes. You would not think that a very good place to study botany, but I had a tin box made—had never heard of a vasculum—and when we were in port I collected plants and put them in the box, closed it up tightly, and then when we got outside I analyzed the plants at my leisure. Of course the running down of a plant to its specific name was the botany of those days.

I soon became dissatisfied with that. I saw references in the back part of the book I was using to flowerless plants, and I wanted to learn something about them. So I started on the search for some book to help me. Nobody that I knew could tell me what to get, so each time that I was in port I hunted the book stores for a book on crytogamic botany. The clerks used to stare at this kid who was using words longer than he was, but one day in Buffalo I went into a book store and asked the clerk if they had any books on cryptogamic botany, and he said that if they had any they would be in the back part of their store. He took me back to a case where they had segregated their works on natural history, and I began to look for the desired book. I came upon a copy of Harris's "Insects Injurious to Vegetation." At that moment I learned that there were books written about insects. I had seen insects in my collecting that had interested me, but had no idea that anybody ever wrote about them. I took the book to the clerk and asked him the price. He said it was ten dollars. That was a good deal for a lad working for pretty small wages. I handed the book back to him sorrowfully and went back to the schooner, but I couldn't get that book out of my mind. The next morning I went to the captain

and drew ten dollars of my wages and went up and bought the book. I then made up my mind that I was going to study entomology.

This must be a short talk so I won't go into the details of my troubles, how I tried to kill the insects by burning matches under their noses, and so on. (Laughter)

Soon after, Cornell University opened, and in the first announcement of the University was a statement giving a list of the faculty, and then a list of professorships soon to be filled. One of them was a professor of entomology and lecturer on insects injurious to vegetation. I saw that that was the place for me to go, for I wanted to study under that professor.

I want to say in passing that the fact that that was announced as one of the professorships to be filled, is due to the broad vision of Andrew D. White, our first president. He had been a teacher of history and a diplomat abroad, but he had the breadth of view to see science coming, and he planned Cornell on lines by which scientific study was of equal recognition with the humanities. I think that he got the idea of the importance of entomology from the writings of Fitch. He had been in our State Senate, had been on the Committee on Education, and Dr. Fitch was then the Entomologist of New York State and the reports of Fitch doubtless came to his attention. At any rate, that was the announcement.

Well, the professorship of entomology was not filled until a good deal later. And very soon after I went to the University, in fact, in my Junior year there was established for me a little laboratory of entomology. It was in a room in our bell tower. You can imagine the size of the room. Among the students (a very small number) who took work in that laboratory, was L. O. Howard.

I was very anxious to learn how to do my work. Up to the time I was made instructor in entomology I had no assistance whatever in entomology. So I made a pilgrimage to Salem, N. Y., to visit Dr. Fitch. That stands out as one of the bright memories of my experience. I found him a very genial old gentleman. He was, as you know, a practicing physician, and like many country physicians, he had an office building out to one side in his yard, a little square building, and in that was a really remarkable entomological library. When I talked with him about methods and how to go to work, he said, "The way to do is to sit down and study an insect." That is what I got from him. But it has always been a blessed memory to have seen that grand old man.

About that time Dr. Wilder, who was my chief, and to whom I owed the opportunities that I had, arranged with Dr. Hagen that I might study with him. Agassiz had been anxious that Hagen should give

instruction. At first Dr. Hagen hesitated, and then he said he would be glad to give a course to one student. So I went on and spent the summer in the museum at Cambridge determining some insects that I carried on, and receiving instruction from Dr. Hagen.

Let me tell you what happened each morning: It was a hot summer. Dr. Hagen, as you will remember, was a stout gentleman. He would come in, in the morning, take off his coat and hang it up back of the door, take off his vest and put it on top of his coat. That left him in his shirt sleeves and trousers. Then he would take a pipe with a long, flexible stem, load the pipe, sit down at a little square table such as you will find in some students' rooms, put the pipe on the floor behind him, and with the mouthpiece in his mouth, he would say, "Now you come and I vill tell you some dings vat I know." Every morning throughout the summer that exact formula was used.

Then, with a pencil and some sheets of paper before him, which he used as a substitute for a blackboard, he gave me a lecture on insect morphology. I believe that must have been the first special course on insect morphology given on this side of the Atlantic. (Applause) And it was a wonderful course. Years afterwards when I gave a course of lectures on insect morphology myself, I would go back for data to my notes on these lectures.

I think that these few reminiscences will show you the growth that there has been, in the memory of some of us who are here. I will not tire you with more. (Extended applause)

TOASTMASTER W. E. BRITTON: We had fully expected to have with us to-night Dr. S. A. Forbes, who is probably the oldest living state entomologist in the country. He has been publishing reports for nearly forty years. As some of you know, Walsh was the first state entomologist of Illinois, followed by Le Baron, Thomas, and then by Forbes. This office was started very soon after that filled by Riley in Missouri, so that the set of Illinois reports is one of the very valuable ones and is necessary in the library of every economic entomologist. But for some reason or other, Dr. Forbes was not able to be present. He has been an investigator, teacher and director of the Natural History Survey of Illinois, and has a long series of reports to his credit. He is a man of splendid administrative ability, I wish that he might be here to give us a few words.

Of course, everything in entomology has developed so rapidly that we hardly know today what tomorrow may bring forth. After hearing the experience of dusting with the aeroplane, I see that we will have to change our old slogan "Let us spray," to that now used by the housewife, "Get up and dust." (Laughter)

Now we have present another man who has been long in the service and he is one of our greatest teachers. I refer to Professor Osborn. He has been teaching for forty years. He has also been an investigator. He has worked with injurious insects and has done systematic work on the Hemiptera, especially the leaf hoppers and the sucking lice. By the way, Professor Osborn, here is a newspaper clipping you may find of use. Somebody wrote to a newspaper and asked, "What is the cause of head lice?" The answer is this: "The same as the cause of goldfish and grizzly bears. Now they wait, then they mate, presently they propagate, two by two and eight by eight, or some such algebraic rate. In mathematics poorly bred, I can't keep such things in my head. The first pair? From some loving friend. And here my cootie tale must end." (Laughter)

Now Professor Osborn has sent out a large number of students who have occupied prominent places in entomology in the United States, Canada and in Africa—perhaps some other countries. I understand that there are one hundred or more engaged in professional entomological work. We would all be pleased to hear a few words from Professor Osborn (Applause)

PROFESSOR HERBERT OSBORN: Mr. Toastmaster, and Entomological Friends: it is a pleasure to address you, especially in such company as I have to-night. I might begin by going back to one of my entomological inquiries. I remember quite a number of years ago I had a letter from some anxious inquirer which read, "I wish you would tell me how to kill *aunts*. I have a lot in the cemetery." (Laughter)

Now the President wrote me a short time ago asking me to give some recollections of the early days of the society, and I thought that I might give you some features of the meetings that might interest you. I shall try to do it in a few words.

I did not attend the first meeting, the Toronto meeting here at the time of the organization, nor the meeting in Washington that shortly followed that, at the time of the meeting of the American Association of Agricultural Colleges and Experiment Stations. But the next year, at the Champaign, Illinois, meeting, I was present, and that we considered in many ways the opening meeting because we had there Dr. Riley, Professor Cook and a number of the leaders, with a program of considerable extent and as it was the first meeting of this Society that I attended, its proceedings are very clear in my mind.

Now the Association of Economic Entomologists we have, of course, looked upon as a daughter of the Entomological Club of the American Association for the Advancement of Science. We have never before heard that there was anything but a mother of this society, and I have always supposed that this Association of Economic Entomologists

was parthenogenetic, I never heard of any record of the father of the society. I think Dr. Howard speaks for himself as one of the fathers. At any rate, the society was homozygous. It was certainly masculine, and it is one of the growths of the society that it now has a number of women who are doing strong entomological work.

The Club was active for a number of years before and after the organization of this society. With your permission I would like to go back a little from the beginning of this society and mention some of the very early meetings of the Entomological Club, which is the genetic ancestor of this Association. The first meeting of the Entomological Club that I attended was in Minneapolis in the year 1883, and there I met the first group of entomologists that it had ever been my privilege to meet, as a group. I had met Professor Riley some years before, in the year '76, I think, and I got some inspiration from that very remarkable, energetic entomologist. But at Minneapolis, along with Professor Riley, there were present Professor Forbes; then in the early years of a notable career; Professor Saunders of Canada, a very charming man indeed and whom I came to consider a close friend in later years; Professor Kellicott who was then located in Buffalo, before he went to Ohio; Miss Murtfeldt of Missouri; C. S. Minot then interested in insect histology, and there were one or two others. But these were the outstanding figures of that meeting, entomologically. I got inspiration for my work there such as all younger members get in early attendances at these meetings. It is an inspiration and stimulus to meet with the older men and find out something about their methods of work, and their personal characteristic.

Now of the original charter members of this society I would like to call the roll, or mention some of the more conspicuous ones, at least, because I think that some of them are practically unknown, or their work not particularly familiar to the present generation. The work they did was so far in the past, there has been so much other work since, that has claimed attention, that it seems to me the students working now often fail to appreciate the quantity or quality of work that has been done by the pioneers. I was not fortunate enough to ever meet Dr. Fitch, or Harris or Walsh or Thomas, but most of the other economic workers I have had a chance to meet and have had in that way an opportunity to appreciate their work better I think than if I had not had personal acquaintance.

On that original list, Professor Riley of course is recognized as the father, almost, of economic entomology in America. His reports on Missouri insects have stood as a classic, and are even yet a model for economic investigation. Professor Forbes has been mentioned already

as one of the leaders in entomological investigation, and his series of reports is one of the striking features of entomological publication for the country.

Professor Cook was a very enthusiastic, energetic man, and I thin that those who knew him personally appreciated his personal character He stimulated a number of young men to go into entomological work, and you know, of course, the fine work done by some of his students.

Professor Comstock has already been before you and I need not say more than a word of praise for his work. I don't know what we would have done without the books and papers that he has written. Professor Comstock and I have had a long standing disagreement. I don't know that he knows of it. We have never had it as a matter of contest between us, but it shows that disagreements can exist without people being aware of them. I don't need to tell you what it is because it is not a serious matter at all and has never interfered with our friendship or lessened my esteem for him.

To go on with the list here, Professor Harvey was one of this original list. He was a professor in Maine and before that in Arkansas.

Professor Webster was perhaps known to quite a number of you because his work extended up to a few years ago. Probably a number of you met him at the Columbus meeting only five or six years ago.

There are two members, Beckwith and Campbell, that were personally unknown to me of this whole list of charter members.

Professor C. M. Weed was one of the charter members at the original meeting, an entomological writer for the old *Prairie Farmer* and whose work in Illinois and Ohio opened a number of new phases of work.

James Fletcher, of course, was one of the outstanding figures of that group of men. He met with us very frequently, especially after the organization of this society, and was always the life of any group of entomologists that got together. He was one of the most charming men to talk with that I ever met in my life.

Professor Bethune has been mentioned, and I think we can give him a great deal of praise for the splendid work that he did on "*The Canadian Entomologist.*" I keep that Journal on my nearest shelf and look at it with a great deal of interest. I started taking that magazine in 1882 and later secured all the back numbers, so I have the complete set before me as an indication of what can be done in continuity of entomological work.

Mr. Wickson was first entomologist and later became director of the experiment station in California, after which he dropped out of entomological work.

Professor Woodworth was for a long time head of the entomological work in California, and was entomologist of the Arkansas Station in 1889.

Professor Garman is still at work in the Kentucky Station.

Professor Lugger who was for a time entomologist in Minnesota, died a number of years ago.

Professor Gillette is still director of the Station in Colorado.

Professor Bruner, one of that group, has a long record of useful service as entomologist of Nebraska.

Dr. Howard doesn't really need to be mentioned at all. He was one of my earliest entomological friends. I ought not to speak of individuals who are not dead but I do want to speak a little about him. Dr. Howard said to me the other day, "You and I have worked together for forty years and never had a fight." That is quite a record for good fellowship; certainly it is quite a record for Howard. (Laughter)

Now, regarding the character of the work of the Association, I think it was mentioned yesterday that the Association was organized as a research society. I do not entirely agree with that. So I want to give you a little account of the early work of the society to bear out my objection.

The first title was "The Association of Official Economic Entomologists" and that was patterned after, I think, the title for the chemists who called themselves the "Official Agricultural Chemists of the United States of America." We held that name for a short time. The idea I think was that it would include those who were officially in entomological work. I remember that there was some question about my eligibility because I was not a station entomologist. Most of them were. The teachers of entomology were a little bit in doubt, and I was pleased of course when they did come around and decide that a teacher in an agricultural college might be an official entomologist. If you will look at the early records, you will find that there was a distinct question of the eligibility of Professor Packard. He knew as much entomology perhaps as any one, except Professor Comstock or Dr. Hagen who was certainly one of the most learned entomologists of that date—the early eighties—and one whom I was glad to know.

I had the pleasure of working one winter with Dr. Hagen and the main thing that he tried to impress on me was that I should not be an economic entomologist. That particular part of his advice I didn't follow.

Now, coming back to the question of the purpose of the society, I think that it did include definitely the matter of instruction in entomology as well as research. The station entomologists of course were definitely research men, but many of them—in fact, most of them—had also the duty of teaching in the agricultural colleges or institutions

of various kinds. So that the combination of research and instruction was certainly a part of their duty, and really a part of the purpose of the original founders of the society.

Moreover, the men in that work, in most cases, I think, had also to do what we would now call extension work. These men went around to agricultural and horticultural societies and sometimes to farmers' institutes, to talk about insects and methods of control for insects, and they were doing the kind of work we have specialized down to a distinct branch of extension entomology. So that we were trying to do in that time the different phases of economic entomology that have been specialized and developed into particular fields at the present time.

The society stood for these different phases of work, so I think it would be a mistake to say that it was strictly and specially a research organization, although every man in it appreciated research work and attempted to do something with it himself.

I think I have given as much as my time permits for the early history of the society and I do not think I need to take your time any further. Thank you. (Applause)

TOASTMASTER W. E. BRITTON: Gentlemen, if there is any controversy between Dr. Howard and Prof. Osborn I would like to have it settled here and now. I think we can promise them plenty of seconds.

It has already been mentioned that Canada and the United States have lived on friendly terms—especially the entomologists—for more than one hundred years. We came up here with a good deal of interest. When I saw your giant policemen of Toronto, I didn't wonder that our relations have been friendly. In fact, your magnificent specimens of mounted policemen make a wonderful impression. I don't believe that a single member of this Association would be eligible for membership in that organization unless it is Newell, and you will notice that he didn't come. That, I think, explains that we understand each other. As Opal Whiteley would say, we have the understanding heart. (Laughter)

Now I heard the address of the President of your University the other night, a very charming one, and he spoke about your modesty. I think you are too modest, especially in so far as entomology is concerned. Of course we have known of the work of Provancher, Harrington, Saunders, Fletcher and Hewitt, no longer living, and the great work they have done. Those of us who had the pleasure of knowing Dr. Fletcher missed him very much when he was taken away. He was one of those very genial men with a great heart, large enough to take in your whole Dominion, the United States and all of North America—in fact, all of humanity. He was a very human man, and a

very true friend. Of course, Hewitt, following him, organized a large Bureau of Entomology in the Dominion. That is one thing that Dr. Howard has to look out for. There is going to be some rivalry between the Bureau of Entomology in Canada and that in the United States. But probably they will continue to help each other as they always have.

I find that you have a large number of promising young entomologists in the service. I was greatly pleased at hearing a paper from my near namesake the other day, and if he can hustle in his entomological work as he hustled in giving his paper, all the entomologists in the United States will have to look to their laurels. (Laughter)

Now we have one more speaker on the program who can tell us something about the work that the entomologists are doing in Canada at the present time. I am going to introduce as the next speaker, Professor Lawson Caesar, professor of entomology at the Ontario Agricultural College. (Applause)

PROFESSOR LAWSON CAESAR: You spoke about the modesty of Canadian entomologists, Mr. Toastmaster. I don't know whether it is modesty or just what it is, but this evening so far as I could find out, our worthy president must have visited every member of the Entomological Society of Ontario, asking him to say a few words. He finally came to me and said, "Caesar, you have got to do it. Every other man said, 'I am afraid. Those fellows know too much for me.' But Caesar, you don't mind," (Laughter) So that is my excuse for speaking for a few minutes to you to-night.

As I listened to Dr. Howard, Dr. Comstock and Prof. Osborn, a thought came to me which I believe expresses the feelings of my fellow Canadian entomologists. The thought was: that though we have had excellent meetings the last three or four days, tonight's meeting has been in real value the equal of all the others combined. I think that expresses the feeling of all of us. (Applause)

One of the wonders to me is that Dr. Howard, Dr. Comstock and Prof. Osborn are today just as enthusiastic in their subject as they ever were. And any of you who knew Dr. Fletcher knew that he was one of the most wonderful men in his enthusiasm. I believe that many of us Canadian entomologists owe our first interest in entomology to having listened to Dr. Fletcher. I was thinking that if Dr. Fletcher had been here along with these other men with his genial talk to add to what has been said, the meeting would have been almost too excellent.

For Canadians, it is a great treat to have had the opportunity to be at this meeting of all the entomologists of North America. We have looked forward to it with a great deal of pleasure. We cannot, with

the same ease as can some of you, go to the American meetings each year and get the value of what is said there, and meet the men there that we should like to meet. So this meeting has been a very great treat indeed to us, not only in the way of the information gained, but also in the social intercourse that we have had with each other.

I cannot sit down without making a few remarks that I know any man who might be taking my place here tonight would like to make. That is in regard to the debt of gratitude that we owe to our entomological friends across the line. It seems to me that we should have been utterly lost during the last twenty years had we not been able to go to them for the assistance that we needed. We have been few in number until the last few years. Why, even at Ottawa there were only about five entomologists when Dr. Hewitt came there. But now I believe there are about fifty on the Ottawa branch. Until the last few years we have had to send our specimens across the line to have them identified, and I sometimes wonder at the patience that Dr. Howard shows in taking the trouble to name those insects for us and to give us the information on them that we desire.

So we owe a great debt to the Washington Bureau, not only to Dr. Howard himself but also to many of his assistants who have helped in connection with these things.

The debt that we owe to Dr. Comstock I cannot put into language. There is not a man—at any rate in Canada—who has not been brought up on Comstock's manual. (Applause) One of the things we are looking forward to today is the New Manual which Dr. Comstock is preparing. We don't want him to hurry with it but to take his own time; and we know that what the book will contain will be just as nearly right as it is possible to make it.

Now, we should like very much to have as many of the entomologists of the United States as can find opportunity to do so, attend from year to year the meetings of the Entomological Society of Ontario. It is not a provincial society at all. It is in name, but in reality it is a Dominion society. We do not want you to come just to please us, but we want you to come to enjoy our meetings and to discuss things with us, just as we want to go back to your meetings and to get pleasure and benefit from them.

I often think that now that we are beginning in Canada to devote a great deal more attention to entomology than we did in the past, that we will be of some help to our frineds across the line, in that we shall be able to give you data from different climatic conditions to what you have over there; and so by cooperating together in the study of insects, both countries are going to gain much more than either country would alone.

Before sitting down I should like to say that a good many of you have never visited Guelph, and we should be glad to have any entomologist who finds it convenient, on his way home, call at the Agricultural College and look over the institution, and come into the entomological department and see anything we have to show you. It is only about forty-five miles. There are several trains a day going there and you can slip up to the college in a few minutes by car when you reach Guelph. I may not be there myself but Professor Baker will show you around.

In conclusion I should like to say that this is the Christmas season and on behalf of the Canadian Entomologists I wish you all a happy new year. (Applause)

The members called for some remarks from Mr. Arthur Gibson.

MR. ARTHUR GIBSON: I didn't come here tonight prepared to speak. I thought I had "passed the buck" very rightfully to Prof. Caesar, our provincial entomologist, and in whose province our meetings are being held. I am glad, however, to add a word or two to what he has said.

As I mentioned at the meetings today and yesterday, the entomologists of Canada have welcomed very much our visitors from across the line. Instead of having you accept the invitation of Prof. Caesar to visit Guelph, I would like to have you all take a train from Toronto at night, before you leave for your homes, and arrive in Ottawa the next morning. We could give you just as good a time as he could at Guelph. And then too we could take you across to the beautiful city of Hull where prohibition is not yet wholly in effect!

I would also like to second Prof. Caesar's remarks and express to you all again our sincere pleasure in having you with us at this conference. May I also repeat what he said, and wish you all a very happy new year.

TOASTMASTER W. E. BRITTON: It seems to me that one of the very best things about this meeting is that we have been getting acquainted. I suppose some of our men from the States will have to return, but now they have learned the way I am sure that some day they will visit both Guelph, and Ottawa, and will also probably stop on the way at Hull.

I would like to propose a toast to the relations between Canada and the United States. May these Nations always stand shoulder to shoulder, heart to heart, and hand to hand, comrades in war, in peace and in entomology. Will you please rise?

The members drank a toast to the relations between the United States and Canada.

TOASTMASTER W. E. BRITTON: This closes the program for the evening, and I wish to thank you for bearing with me so patiently. We will now turn the meeting over to the President, who has an announcement to make. (Applause)

PRESIDENT GEORGE A. DEAN: As I have sat here this evening and listened to the admirable and charming addresses of the pioneers or charter members of this Association, an Association which has done so much to promote a well-balanced growth and development of the science of economic entomology, I have been deeply impressed by the splendid spirit of sacrifice which has dominated their lives and led them to devote their lives to the accomplishment of so much constructive work.

As has been stated this evening, a few energetic workers met in this city of Toronto, thirty-two years ago last August, and organized the American Association of Economic Entomologists. The wonderful success of the organization and its long record of usefulness has certainly justified the venture which was launched by these men who had that rare faculty of seeing the possibilities and opportunities of the future.

During its rapid and healthy growth from not more than a dozen members to a membership at the present of nearly 700, the Association has had 31 presidents, two of whom, Dr. Riley and Dr. Forbes, have served two terms. Of the 31 presidents, 8 are gone, but the memories and the classical contributions to science by such men as Riley, Fletcher, Lintner, Webster, Slingerland, Smith, Fernald and Hewitt will remain as long as the science of entomology endures.

Of the 23 past presidents who are living, more than half of them are present this evening.

Two years ago when the Committee on Resolutions, consisting of Messrs. Sanders, Ruggles, and myself, recommended to the Association the presentation to the past presidents of an engraved diploma, little did we realize what a fitting occasion would occur as this, the thirty-second anniversary, in the city of Toronto, where this Association was not only organized but also at which place the first annual meeting was held.

As President of the American Association of Economic Entomologists, it is my privilege and indeed a great pleasure to present to each of you in order of your term of presidency these diplomas. The diplomas are presented by the Association in appreciation of the honor each of you have so well earned by your fine spirit of sacrifice and your splendid endeavor to the development of the science of economic entomology.

It is particularly appropriate that the first diploma should be presented to Dr. Howard, who not only served on the original committee of organization, but who in order of term is also the oldest past president.

PART II, ADDRESSES, PAPERS, AND DISCUSSIONS

Morning Session, Thursday, December 29, 1921

At the close of the business session, Vice-President Arthur Gibson took the chair.

VICE-PRESIDENT ARTHUR GIBSON: One of the most important items on the program each year is the address of the President, and it is my pleasure to introduce President Dean, who will address you on the subject of "How We May Increase the Effectiveness of Economic Entomology."

HOW WE MAY INCREASE THE EFFECTIVENSS OF ECONOMIC ENTOMOLOGY

BY GEO. A. DEAN

Entomologist, Kansas State Agricultural College and Experiment Station

With the publications of Walsh (1865–1869) and the early publications of Riley (1868–1877), Economic Entomology in the United States began to advance rapidly. The classic contributions of these two men, particularly those of Riley, laid the foundation for the economic entomology of the world, and the rapid growth that followed soon placed America at the head of all countries, a position she has continued to hold. Economic Entomology has contributed much to the marvelous development of American agriculture, which forms the basis of American civilization and prosperity. With this rapid development, not only have many new fields for research been opened and great opportunities for service offered, but the problems also have become much more complicated and the entomologist's relation to them much more intricate.

If the great problems are to be solved and the entomologist's splendid position of service maintained, three fundamental considerations must be recognized. (1st) Fundamental training for research must be insisted upon and its importance emphasized. (2d) An agreement as to which are the most fundamental problems of research and which are the most promising methods of attack must be reached, so that the

available resources may be concentrated. (3d) A workable plan for cooperation among entomologists, with other scientists, with public and private agencies and with the general public must be developed and supported.

Education and Training

The matter of education and training is one to which considerable attention may well be given. Economic entomology is a science intimately related not only to all other biological sciences, but also to many of the other sciences. Since it reaches out in its great variety of adaptations and touches almost every vocation of life, it would seem that any person who has given the subject earnest thought would advocate a broad and fundamental training along all biological lines for the person who would enter the field of economic entomology. Never in the history of education have our educational institutions and research laboratories offered better opportunities than they now offer for the student to receive this broad and fundamental training. In many of these institutions there are teachers of excellent training, broad vision and high ideals. Every year there are entering the field some splendid young men, well trained in science, and full of enthusiasm and zeal, who have caught the proper inspiration and have the right attitude in research. But is this any reason why our educational system should not be studied to ascertain if the basic studies are being offered? However, it is not my purpose to discuss this important problem, because growing out of Dr. Ball's admirable address given at the thirty-first annual meeting, there is the Committee on Policy, under which there is a committee on education, whose problem it is to study our educational system to discover whether the basic and fundamental subjects in the training of students are being offered and required. I look forward to a report from this committee that will be of vital importance.

Research

Out of the lessons and experiences of the recent war came an unprecedented recognition of the value of research. Never before have the nations, particularly our own, been so willing to give encouragement and support to research. Never before have there been so many well trained men engaged in research, and so many great economic problems. On the other hand, is there not a large amount of lost motion? Is there not a lack of organization, cooperation and coordination? Are not a large number engaged on research problems of minor importance, and many working on problems and getting nowhere, and

are there not some great basic problems practically untouched? As illustrations, one might mention the reciprocal relations of soils and insects, the influence of temperature and moisture on insect life, the breeding of insect-resistant varieties of plants, and the relation of insects to the dissemination of plant diseases. Would it not be a good plan for this Association to make a thorough study of our multiplicity of research problems and endeavor to decide what are the most essential, and then plan for concerted attack on the large problems, especially those that require numerous cooperative workers? But, it is not my purpose to discuss the research problem, as basic as it may be, for here again the subcommittee on research of the Committee on Policy is studying this phase of our entomological work, and I hope we may soon have from them a report on this important problem.

Cooperation

Although the importance of fundamental training and research cannot be over-emphasized, and while I would not in any way minimize these two problems, there is, in my opinion, a larger problem, namely cooperation, or the development of a workable plan for coordinating and harmonizing all activities not only in entomology but also in related fields. In the final analysis is not the ultimate purpose of all research to serve the public, and can this ever be fully accomplished unless the closest cooperation and sympathy exist? I am well aware that in recent years so much has been said about cooperation and there have been so many failures that the word "cooperation," like the word "brotherhood," has become repulsive to some. Yet, by placing constant emphasis on the problem, may we not expect our efforts to lead to constructive activities? True, there will always be in each group some individuals who are intensely selfish and who seek every advantage for themselves without regard to the interest of the public, but the hopeful sign at the present is the realization that those who take the larger view are increasing steadily, and the spirit of cooperation is growing.

One of the essential requirements for the largest success of a research worker is that he be imbued with a spirit of altruism. If there is any class of scientific men that should appreciate the value of cooperation and recognize the wonderful opportunities offered for cooperation, and be able to profit from the failures due to the lack of cooperation, it is the economic entomologist. He is engaged in a work that not only reaches out in its great variety of activities, and touches almost every vocation and activity of life, but which also has many striking examples of work accomplished through cooperative activities, as

well as some glaring examples of failure, due to selfishness and lack of cooperation, and opportunities lost, due to the lack of vision and lack of aggressiveness.

Cooperation Among Entomologists

Throughout the country there are a large number of economic entomologists working on very similar problems, and to a considerable extent independently of each other. Of course, these investigators can learn more or less of what is going on by attending meetings, reading current publications, and corresponding with fellow workers. But in this there is comparatively little cooperation between the numerous agencies and no direction or supervision which would result in concentrating efforts along the most desirable lines, enabling the workers not only to do more efficient work and to render more effective service, but also in many instances to avoid unnecessary duplication.

It would seem that one of the best means of promoting close cooperation would be for those workers who are interested and engaged in similar entomological problems to hold conferences and field meetings. Conferences of this sort are certain to stimulate interest in economic entomology and focus attention on economic problems of outstanding importance. Conferences between entomologists for the purpose of exchanging ideas, holding advantageous consultations and observing experimental results of special significance are highly desirable and are almost certain to result in speeding up research and experimental activities. Perhaps one or two examples, with the details of which the writer is well acquainted, will illustrate.

Fourteen years ago the departments of entomology and agronomy of the Kansas Agricultural Experiment Station began an extensive series of experiments on the preparation of the seed bed and the time of planting wheat not only for maximum yields but also to escape injury from the Hessian fly. In order to secure the data bearing on the problem, a series of experimental sowings was begun which was to extend over a period of ten years.

The experimental sowings were carried out at a double series of stations, one along the eastern and one along the western edge of the great central wheat belt of Kansas. Each sowing consisted of seeding a series of plots at weekly intervals for six or seven weeks, beginning the second week in September. The stations were always secured and managed cooperatively by the departments of agronomy and entomology. Representatives of the United States Bureau of Entomology visited most of the stations each year, taking such data as they desired. As a result of the long series of experiments, Kansas not only has a method of Hessian fly control that is practically 100 percent

effective, but also valuable data for every part of the state regarding the preparation of the seed bed and the time of planting for maximum yield. There are no conflicting statements emanating from the experiment station. The agronomist, the entomologist, the director of the experiment station, the county agent, and the wheat grower, all talk the same language. In addition to this, the Kansas Station has very valuable data on the life history of the Hessian fly, the number of broods, its behavior, its migration, its dispersion by winds, and its susceptibility to moisture and temperature. The point, however, that I wish to make is that if a similar series of experiments had been conducted in all the winter wheat states, subject to injury from the Hessian fly, who would dare to estimate the amount of valuable data we would have on this important insect?

If at the beginning, a regional meeting could have been held between the entomologists and the agronomists of the interested states, and the plan of the experiments explained, ideas exchanged, and later experimental results observed, it is probable that similar experiments would have been inaugurated, and to-day we would be reaping the results of unification of efforts, and the great wheat growing industry would feel the force of our work as a solid impact.

It is estimated by the Federal Bureau of Entomology* that in the year 1907 there was a loss of not less than 50,000,000 bushels of oats and wheat in Kansas, Oklahoma, and Texas, due to the green bug. Seventy percent of the wheat acreage in Texas was abandoned that year because of the ravages of this formidable pest. Other outbreaks, though much smaller, occurred in 1911, 1919, and 1921. During the first outbreak, although there was some splendid cooperation between the Federal Bureau and the Kansas Station, there was but little cooperation between the entomologists of these interested states or between the different departments in a single state. Articles soon appeared in the farm journals and newspapers diametrically opposed to each other. The entomologist of one state with more than a full page article in the leading farm journal of that state was bitter in his attack on the state entomologist of another state. Publications even appeared in bulletin form discrediting the work of a fellow worker. While this envy, jealousy and bitterness was on display, the green bug was playing havoc with the wheat and oats, and the farmers were disgusted, not so much with the green bug as with the silliness and foolishness of the entomologists. Since the 1907 outbreak of the green bug, three smaller outbreaks have occurred, each furnishing splendid opportunities for an extensive study, but each time very little

*Farmers Bul. 1217, U. S. Dept. Agric. 1921.

was accomplished, due to the lack of any well-thought-out plans between the entomologists of the interested states and the Federal Bureau. As the result of this more or less of a hit and miss proposition, we have scarcely arrived anywhere with the most fundamental aspects of the green bug problem. At the present time there is a difference of opinion between the federal entomologists and those of Kansas as to the origin of these outbreaks. The federal entomologists and the entomologists of Kansas do not agree with the pubished statement of the state entomolgist of another state as to the origin of the small outbreak last spring in southeast Kansas. The green bug problem is one that cannot be worked out in a single state, and the entomologists will never get at the bottom of the situation until they decide to get together on a whole-hearted, well-developed, cooperative plan. When this is done and the origin of the outbreaks are definitely known, they can then expect to render effective service along the line of efficient control.

Many examples could be given by a large number of entomologists of the efficient work and effective service rendered by cooperative experiments. Several have attended regional conferences and field meetings, and know that they are highly desirable. They know that out of these conferences constructive activities have grown, whereas if it had been left to the initiative of the individual, no important result would have been accomplished.

I firmly believe that one's greatest inheritance is individual initiative, and in all this work I do not favor any step that would discourage the initiative of the investigator nor do I favor any plan that would lead to the establishment of anything that savored of autocratic control. But it does seem to me that entomologists must learn to work with others and that there can be a closer cooperation between state and federal entomologists without jeopardizing in the least the freedom or the reputation of either. Along this line I am particularly grateful for the recent organization of the Crop Protection Institute and believe that the Association of Economic Entomology, by endorsing the Crop Protection Institute and placing itself on record in favor of this organization, took a big forward step, just as it did when it formally approved of and promised its support to the National Research Council.

Cooperation Between Entomologists and Other Scientists

While the economic entomologist recognizes the fact that his science is tremendously broad and intricate, and in its many aspects is intimately related to all the biological sciences, he has, nevertheless, given very little attention to the relationships with other scientific workers, and has proceeded with his insect problem as if it were one for the exclusive attention of an entomologist.

It must be made clear to every student in economic entomology that our studies in the sciences have been too restricted and that there is such an interrelation and interdependence of our problems with those of other fields that the development and solution of them cannot be considered separately without loss.

The entomologist of the future will be required more than ever before to deal with problems involving interrelationships between many fields of science. Unless he has a comprehensive knowledge of chemistry, physics, plant pathology, plant genetics, agronomy, horticulture, geology, bacteriology, sanitation, and other subjects likely to enter into his problem, he cannot expect to get basic results which will contribute to the development of a nation. It is not meant that the entomologist must be a specialist in all the biological sciences. This is impossible. But it is meant that if an entomologist is to develop successfully a problem and overcome its difficulties, he must be equipped with sufficient fundamental training in the different lines to be able to recognize the obstacles encountered, and interpret the factors involved in his experiment. And when he has done this, he should be big, broad and generous enough to invite to his assistance the scientists who can materially contribute to the solution of his problem. In fact, his training should be such that, in planning and developing his problem he will be able to foresee the different interrelationships and the possible and probable difficulties, and sense the desirability of calling into consultation, and even active participation, investigators in other lines. The effective method of Hessian fly control in Kansas is not the product of an entomologist, but the product of a long series of cooperative experiments of entomologists and agronomists.

Kanred wheat, a hard winter variety that is outyielding any other hard wheat by several bushels per acre, that is rust-resistant, that stands at the top in milling and baking qualities, is not the product of a single individual, but is the product of the Kansas Agricultural Experiment Station. It was bred and selected by a plant geneticist. Its yielding qualities were determined by agronomists in cooperative work with farmers; its rust-resistant characters were ascertained by a plant pathologist, and its milling and baking qualities were the work of flour milling engineers, baking experts and flour chemists.

If any Experiment Station produces a wheat that is Hessian fly resistant and has the other necessary important characters, it will not be the work of an entomologist alone, but will be the result of a cooperative project between entomologists, plant geneticists, plant physiologists, plant pathologists, and agronomists.

Cooperation With Industrial Concerns and Other Private Agencies

Many illustrations could be given of splendid results accomplished by entomologists' cooperating with industrial concerns and other private agencies. As one studies this problem, he is increasingly impressed with the many possibilities offered, and the numerous fields practically untouched. Along these lines, Parrott, a foremost student of this kind of cooperation, and our representative on the National Research Council, in his report a year ago to this Association, says "There also exists a large opportunity for enlisting the support of men of affairs, who can assist in coordinating civilian enterprises with entomological activities and shaping public sentiment in its judgment of the character and efficiency of entomological efforts in behalf of national welfare. Industrial concerns, individually and collectively, are prepared to grant funds for the investigation of special practical problems."

In the Crop Protection Institute affiliated with the National Research Council and endorsed by this Association, there is a splendid organization for doing cooperative work with industrial concerns and with their cooperation and their support to accomplish some really stupendous tasks.

Cooperation With The Public in Insect Control

This represents one of the most important phases of economic entomological work, since in the last analysis the ultimate purpose of our studies and research is to discover and develop practical methods of insect control and to serve the public, not only by devising machinery for the practical operation of these methods, but also in assisting in the running of this machinery. The Crop Protection Institute affords a much needed organization for cooperative work on general problems of insect control. If it receives the proper support, it should be able to establish a unity of interest and demonstrate the possibilities and value of regional cooperative insect control.

Undoubtedly the greatest and most important organization for concerted action in insect control is the state and county farm bureau. It is difficult for the writer to understand why some of our station and state entomologists are not using this splendid piece of machinery. That the county farm bureaus within a state can be organized into an efficient machine which can be thrown into action and present a solid front within a period of two or three days is no theory. It is this organization that makes it possible for the farmers of Kansas effectively to control the Hessian fly infestations and the grasshopper and army worm outbreaks.

In cooperative insect control, the extension entomologist is a most valuable man. In fact, I believe that economic entomology, research and extension entomology are inseparable from and indispensible to each other in a real department of entomology that intends to serve the public. The extension entomologist who represents such an important phase of entomological work should be closely affiliated with the department of entomology. His plans and his work should be worked out in close cooperation with and be approved by the head of the department, or some person in the department who is in direct charge of that particular work. Otherwise friction is almost certain to result, and information will get abroad that will be no credit to entomological work or to any institution. The extension entomologist should have his office in the department of entomology, where he may keep in close touch with the work not only in the department, but in the whole station, and where he will feel that he is one of the men of the department. Furthermore, the extension entomologist should be permitted to carry on some independent research work in the department.

In cooperating with the public, advantage should be taken of the valuable help which can be rendered by organizations such as the grange, farmers' union, bankers' associations, grain associations, millers' associations, fruit growers' associations, railway companies, canning associations, various clubs, etc. In much of the work of this sort, while the entomologist should be the leader in the organization, and the underlying force in the operation of the methods of control, he should know how to step into the background and let the county agents, or the particular organizations through which the work is done, feel that they are important factors and function as such.

Conclusion

If economic entomology is to fulfill its destiny and keep abreast with the rapid growth of other biological sciences and the marvelous development of agriculture; if it is to continue to make notable contributions to the progress of the nation and the world; if it is to develop on that broad and constructive plane so necessary for the rendering of the maximum service and usefulness; if it is to accomplish achievements of such importance as to be the subject of favorable comment and receive the commendation of the general public, there must be a closer cooperation and a more sympathetic and generous attitude: 1st, between state and federal entomologists; 2d, among state entomologists engaged in similar entomological problems; 3d, between entomologists and the other biological scientists; 4th, between entomologists and medical men; 5th, between entomologists and industrial

enterprises; 6th, between entomologists and sanitation engineers; and 7th, between all of these and the general public. In the undertaking of such a plan, there are involved so many fundamental principles to which such careful consideration must be given that the task assumes enormous proportions. If there is developed a workable plan that will insure efficiency, it will not be the product of a single person, but of a group of men who have that rare faculty of seeing the possibilities and opportunities of the future and who believe the impossible can be done. Because the task is stupendous; because there have been failure and quarrels in the past, due principally to misunderstanding, petty jealousy and lack of vision; because there are those who cry out "that it can't be done," should one fold his arms in hopeless despair and cry out "impossible?"

Is there any reason to despair of ultimate success when there is so splendid an organization as the National Research Council with which so many associations, scientific societies, and industrial concerns are affiliated, already clearing the way? No, I believe not, for never before have the entomologists had better opportunities for fundamental training in research. Never before have we had such a large group of well-trained men filled with inspiration, interest and zeal. Never before have we had more promising opportunities to render real service; nor has there been a time when such splendid machinery for service was waiting to be thrown into motion, and never before have we had such an opportunity to organize the intellectual forces of our Association into a movement that will have a profound influence upon the future of our science and the well-being of our country.

VICE-PRESIDENT ARTHUR GIBSON: The discussion of this address will take place at the beginning of the afternoon session.

President Dean resumes the chair.

PRESIDENT GEORGE A. DEAN: The next subject is

ECONOMIC ENTOMOLOGY IN QUEBEC DURING THE LAST DECADE

By REVEREND FATHER LEOPOLD, *Agricultural Institute of Oka, La Trappe, P. Q.*

(Withdrawn for publication in the 52d Report of the Entomological Society of Ontario for 1921)

Adjournment.

Afternoon Session, Thursday, December 29, 1921

The session was called to order at 1.30 P. M. by Vice-President Arthur Gibson, and the first paper was presented by Mr. E. G. Kelly.

COOPERATION OF AGRICULTURAL COLLEGES WITH HIGH SCHOOLS AND RURAL SCHOOLS IN ECONOMIC ENTOMOLOGY

By E. G. KELLY. *Extension Entomologist, Kansas State Agricultural College*

In teaching entomology to students of agriculture in high schools and rural schools to-day, we are training leaders for "Insect Control Teams" in the insect out-breaks of tomorrow. With this slogan in mind, the writer began working with high school students in 1915, even before he took up work with the Kansas Agricultural College. Mr. E. A. White was elected teacher of agriculture in the Sumner County High School of Wellington, Kansas for the term of 1915–16. I was appointed chairman of the committee on agricultural projects by the board of trustees and directed by them to outline the agricultural project work for the high school. Among the other projects undertaken by the agricultural class was insect control. During the fall of 1920 and again in 1921, Mr. W. A. Boys, County Agent of Sumner County, used some of the boys who received entomological training in 1915–16 in organizing his chinch bug burning campaign. He found that these men had been so well drilled that further explanation was unnecessary, thus making his work much more efficient than where untrained men were used.

In 1918, shortly after assuming my present duties as extension entomologist of the Kansas State Agricultural College, I was working on grasshopper control in western Kansas, a report of which was presented to the America Association of Economic Entomology at the St. Louis meeting. In this report no mention was made of the work done through the rural high schools. In Pawnee County, Mr. R. P. Schnake and the writer worked in three schools during the spring term, teaching the agricultural classes how to mix and distribute poison bran mash. In the immediate vicinity of these three schools the grasshoppers were controlled during the outbreak in the fall of 1918, and these boys were used as instructors by the county agent in the campaign against the grasshoppers in 1919. These two instances are sufficient to show the possibilities of cooperation between the college, the high schools and the rural schools.

In the early spring of 1920, this cooperation was continued by organizing orchard management teams in classes in vocational agriculture, at Ashland, Bucyrus, Effingham, Bonner Springs, Oskaloosa and Lawrence. These teams were trained in pruning and spraying; the

training in spraying being given with special reference to the control of insects. These teams were also taught to recognize many of the orchard insects. After receiving this training under supervision of the entomologist these boys had an opportunity to put theory into practice by pruning and spraying the home orchards for many of their neighbors. These orchard management projects were continued, and the schools at Seaman rural (Topeka) and Marysville were added in 1921.

By special request from a number of the vocational agricultural teachers to their director, Prof. C. V. Williams, I was invited to appear before the conference of vocational agricultural teachers, held in Manhattan the first week of June 1921, to discuss the plan for cooperation and organization of orchard management teams. This invitation was accepted and advantage was also taken of the opportunity to present a plan of cooperation by which entomology might be taught to vocational agriculture classes. The plan, which met the approval of the vocational agriculture teachers and their director is as follows:

1. That the vocational agriculture teacher have a well organized class in agriculture consisting of not less than ten boys.

2. That the vocational teacher pledge himself to take the correspondence course in economic entomology as given by the Home Study Department of the Kansas State Agricultural College.

3. That each teacher receiving these lessons, shall teach his agriculture class entomology, not less than one hour per week, using these lessons as a basis for such instruction.

With this plan in view, Mr. George Gemmell, of the Home Study Department, and I arranged 32 lessons on Economic Entomology. This provides for one lesson each week during the school year, allowing for vacations. One lesson is sent to the teacher each week, a special effort being made to have the lesson arrive when the insect can be found in the field.

At the time of the organization of this enterprise, Prof. Williams had 75 high schools in Kansas organized for vocational agriculture, in connection with the Smith Hughes plan, each scheduled to take up this work. However, Prof. Williams resigned the Vocational Agriculture Directorship in July and it became necessary to change the plans, under the new organization. Thus it was deemed advisable to retain only those schools on the entomological project which had their classes well organized, and were in a position to forward the movement without the direction of Prof. Williams. Accordingly, a letter was drafted and sent to each vocational teacher, requesting a statement of progress made in organization of the classes for the work, and asking each to

express his desire to continue or discontinue the work under the new arrangement. From the number responding, there were selected nineteen schools.

Shortly after the beginning of the school year, arrangements were made for the entomologist to spend one day with each of these nineteen schools. The program for the day consisted of a short talk on the lessons which had been received, a short laboratory exercise, and a trip to the farms nearby where insects were studied as they occur in nature. One or two demonstrations of insect control, such as fumigating a wheat bin for weevil, and burning the bunch grass for the chinch bugs were given. One very interesting feature of the field trip was teaching the boys and their parents how to find Hessian fly. On these field trips we usually collected various insects, some which were of economic importance.

The vocational teachers cooperating with the county agent invited the parents of the boys to join us on the field trips. Some of these field trips were very well organized and planned. For example, at Beloit, Mr. S. D. Capper, vocational teacher, has a class of fifteen boys. At the beginning of the school term, Mr. Capper invited the parents of his boys to meet with him in the school room for the purpose of organizing an advisory council.

On receiving word that I would spend a day with him, Mr. Capper called a meeting of his advisory council and they planned the program of the day. It consisted of an hour given to discussing insects followed by farm visits where we studied various insects. The parents of the boys, and neighboring farmers had been invited to attend these meetings and on our arrival at the first farm, we were greeted by an even dozen of them who had come to see the demonstration. We went into a sudan grass field where chinch bugs had recently been very numerous, having damaged the grass to a considerable extent. The farmer had not plowed the sudan grass, but had left it for this occasion. To his great surprise and chagrin, we could not find bugs in the sudan grass. He then essayed to take us to another place where he knew the bugs were plentiful; this time to a corn field, where the corn had been cut and shocked. Here, again, he was disappointed, for all that he could show us were great piles of molted skins of chinch bugs. At this time I discussed the chinch bug and its habits, paying especial attention to hibernation, after which we tramped across the field to the roadside where the blue-stem grass was growing in great clumps. Here is where we found the missing bugs. We set fire to a small strip of the bunch grass, thus demonstrating the most effective method of control for this pest.

We then drove to the second farm selected by the council where we studied weevil in wheat, the farmers accompanying us. The various species of weevil found in the wheat were discussed, and others not present were mentioned. The bin was then measured to determine the number of bushels it contained, examined for cracks, etc., and the temperature of the wheat taken; finally the amount of carbon bisulphide needed was determined. Gunny sacks were placed on the top of the wheat in readiness to receive the carbon bisulphide, the pouring of one pound on each sack was a simple operation; the wheat was fumigated.

The next stop was for luncheon where we were joined by other farmers and the teachers and pupils of three rural schools. Shortly after apples had been passed, advantage was taken of the opportunity to tell them how the worms were kept out of the apples, and by using simple language the codling moth and several other insects were described; their undivided attention was given me for forty minutes.

We were ready to go to our next place when one farmer said he had come to learn about the chinch bug. I requested some of Mr. Capper's boys to explain the subject—they did it well. Another farmer wanted to know about the wheat weevil. The boys told him in a clean-cut decisive manner just how to fumigate the bin.

At every school visited similar interest was exhibited. The boys and their parents took advantage of every opportunity to gain all the information possible about insects. In the nineteen schools cooperating, there are about 409 boys and 42 normal training girls. Many of these boys are deeply interested in insects and each of them has written an essay on one of six entomological subjects submitted to them. These essays were written under the supervision of the vocational teacher and English teacher of the school. In all the agricultural projects assigned to the boys during this school year, insect control will be included as part of the project.

The county agents in the counties where these schools were located, cooperated with the vocational agriculture teachers in making these meetings a success. The County Agricultural Agent is the recognized local leader in all extension activities in the county. He is the man in the county who disseminates information brought to him by the specialist concerning results obtained by the experiment station and United States Department of Agriculture.

In order to work most effectively, he must have a system of local organizations. Among these are the agriculture classes in the high schools and rural schools. In developing the agricultural program for any local organization, whether it is crops, horticulture or live stock, insect control is always included as a part of the program.

There are fourteen counties in Kansas in which the county agents have organized extension schools, for studying entomolgy. As now planned, the extension entomologist will spend one half day at each of these schools, which will consist of the members of the agriculture class of the local school and the parents of these pupils. Demonstrations on why, where, when and how to spray will be given; also short illustrated lectures on a few of the economic pests. At this time, it is planned to assign to the members of the agriculture classes and farmers some definite entomological work, that they may do, either as teams or as individuals, such as keeping the bugs off their potatoes and spraying fruit trees for the control of codling moth and curculio; the control of chinch bug and Hessian fly and other local insect problems.

VICE-PRESIDENT ARTHUR GIBSON: This morning we listened with a great deal of pleasure to the address of our President. It is now open for discussion.

MR. W. R. WALTON: I have listened with the keenest of enjoyment to Professor Dean's discussion regarding the best means of increasing the effectiveness of economic entomology. I think we can all agree in endorsing his ideas regarding the cooperative relations which should obtain between the State entomological organizations and those of the Federal Bureau of Entomology. In this regard I can and do point with pride to the fact that ever since the Branch of Cereal and Forest Insect Investigations has been under my direction, our watchword in this work has been "Cooperation and Service," in so far as relations with the States were concerned; and I believe that Professor Dean will be the first to acknowledge that such has been the case in his own state of Kansas. I feel, however, that perhaps he does not realize fully the spirit of intimate cooperation in the Hessian fly and other regional problems which has prevailed for years between the Federal organization and those of such States as Ohio, Indiana, Illinois, Missouri, and to a somewhat lesser extent, Michigan. It seems probable also that similar relations maintained with North Dakota, Montana, Wyoming, Arizona, North Carolina, Texas, Virginia, other states and the Dominion of Canada, between the Federal Cereal and Forage Insect men on one hand and the state organizations on the other, have not come to his attention.

Great praise certainly is due Professor Dean and his admirable and enthusiastic corps of workers, together with the Kansas state staff in general, for their invaluable and pioneer work on the control of the Hessian fly and other insects, but I hope he appreciates the fact that similar good work is now being accomplished in other states, in fact, has progressed for years, in full cooperation with the Federal entomolog-

ical agencies. The collaboration of our investigators during the past year with the plant pathologists and agronomists in the "take-all" disease investigations in relation to Hessian fly injury, is a case in point. Referring to the "greenbug" situation, mentioned by Professor Dean, it is true that honest differences of opinion exist as to the true origin of the great outbreaks; but such differences do not necessarily constitute obstacles to progress, indeed they are often the very life of scientific research. The Bureau recently has taken steps (by placing an observer in northern Texas) to settle this matter, once for all, if this should prove to be humanly possible.

I congratulate Professor Dean upon his extremely able and interesting presentation of this most important subject.

MR. E. P. FELT: It seems to me that Professor Dean in his discussion has struck a keynote which we can all take to heart. That is, a better and closer cooperation, and even in cases where there is an honest difference of opinion, sometimes by consultation, at least a form of statement can be agreed upon which will not result in presenting apparently diametrically opposite views. I feel the liberty of disagreeing with my associates at times, and I expect they are going to disagree with me, but I like, if possible, to keep that out of public print. We ought to present, so far as possible, a united front in urging remedial or control work along any line whatsoever.

There is one thing I would like to mention in connection with Professor Dean's address, and it is also cooperation. I refer to the cooperation that the men in the States should render the Insect Pest Survey work begun last year. That was started, as you gentlemen may remember, partly at least through action taken by this association. There has been some excellent cooperation. There is an opportunity for a great deal more, and it seems to me that this venture—we can hardly call it less than that—is in the experimental stage. It is something which should demonstrate its utility. To my mind it has considerable, if not great possibilities. We ought not to be content until those possibilities have been developed to every reasonable degree. We do not think it is going to solve all questions; it cannot. But we ought to have eventually an Insect Pest Survey which will picture accurately and promptly entomological conditions throughout the entire country, so that those cooperating both in Washington and throughout the country would have a better and fuller knowledge of what is going on in insect life, and therefore be in a position to render better service to their clientage.

MR. S. J. HUNTER: I want to express my hearty appreciation of the matter presented this morning by Professor Dean, but more especially to testify that he not only preaches, but he practices what he preaches.

We at the University have enjoyed his cooperation both in the research work and in the teaching work. Professor Dean himself has come to the University and given an entire term of lectures through one summer session, and his men at different times have been with us. He has demonstrated in a very clear manner in Kansas the policy which he has outlined so clearly and cogently and forcefully this morning.

I also want to second what has been said regarding the Insect Pest Survey. After the Insect Pest Survey Bulletin came to us for three or four months, our instructor in economic entomology in the University began using it as a collateral text. It was not suggested to him but he asked the privilege of taking an additional set for that purpose, and I took occasion at that time to write Dr. Howard expressing our appreciation of the information contained.

I have a feeling that the President's address stimulated what is already growing in the atmosphere. I wish to congratulate him on the thoughtful and comprehensive way he has presented the subject of cooperation to us.

MR. W. C. O'KANE: You will remember that in dividing the various portions of his address, Professor Dean spoke first of research, as indeed he should since it is fundamental in any science. Then he went on, however, and showed the importance of various other aspects of economic entomology besides research; the relation, in other words. of the economic entomologist to his public, to his fellow workers in other sciences, to the industries with which he comes in contact, and so on.

Now economic entomology is one of the two sciences in agriculture that is of a corrective or remedial nature, the other one being plant pathology. It is in daily comparison in the State Department at Washington or in the State Experiment Stations with such constructive sciences as agronomy, horticulture and so on. We are like the doctor who is called in at the last minute and as a last resort and quite unwillingly, and who is discharged the sooner the better. In other words, our science is one which is of a corrective, remedial, preventive nature.

Therefore, like any other such science, it has strong engineering aspects. I personally believe those engineering aspects are of very rapidly increasing importance at the present time in economic entomology. One thing I liked especially about Professor Dean's admirable address is the fact that he made clear what those aspects are.

MR. H. A. GOSSARD: I rather wondered this morning, when Professor Dean was reading his paper, if he had been up in our section of the country in the last two or three years and studying what we are doing. We were apparently doing, over in that quarter of the world, about all the things that he was recommending, and I believe we are actually getting somewhere. We have enjoyed very efficient cooperation

with the Federal Bureau of Entomology, we have had meetings or conferences of entomologists in that section of the States, one or two each year, and worked out our common problems together. We have all of the entomological agencies—the research agencies and the teaching forces—and we are utilizing them all. The Farm Bureaus also have helped us out wonderfully.

I certainly endorse practically everything that Professor Dean said, and from trying to utilize the forces that he recognizes, I certainly am sure they will accomplish a great deal. I was thinking that last year's address and this year's address both touched quite forcefully upon that same aspect—the benefits of team work. It has come to be recognized that agriculture has come to be so thoroughly organized, so thoroughly inter-dependent—the different forces of it—that when we all unite together we can accomplish things that we would not have dreamed of years ago.

That of course does not in any way mean that we cannot disagree. It doesn't mean that there may not be dangers from too much cooperation. I myself thoroughly enjoyed that thought-provoking article presented at the Chicago meeting on organization of research by Dr. W. M. Wheeler. And while I think that we must, to a large extent, utilize the forces prescribed last year by Dr. Newell, and this year by Professor Dean, I think there is a great deal for us to think over very thoughtfully in Professor Wheeler's address; and when we have considered them together we will find the viewpoints are not so diametrically opposed to each other as might appear on first thought.

MR. P. J. PARROTT: Professor Dean selected a splendid subject for his address, and he discussed it in a manner which I am sure meets with the approval of all who heard him. More serious attention should be given to his suggestions, but as other members have dwelt on them, it is hardly necessary for me to prolong the discussion. However, I do wish to express my hearty approval of the desirability of more cooperation between individuals in different state institutions, as well as with those in adjoining states who are interested in similar problems. The cooperative project among phytopathologists and entomologists to determine the value of dusting and spraying to combat apple pests, and the summer meeting of interested workers and fruit-growers impressed me with the great need of more such activities in all areas of the country. These efforts promote friendly relations among scientific wokers and provide opportunities for the exchange of ideas and consultation. They can hardly fail to stimulate better methods in planning and conducting experiments and to encourage greater caution in interpreting experimental results. Then again, farmers enjoy these

field meetings, and I believe there are great possibilities in large co-operative efforts to impress the public with the value of entomological activities.

Other points might be discussed, but Professor Dean presented them very clearly. Our members should take them all to heart and put as many of them as possible into practice.

VICE-PRESIDENT ARTHUR GIBSON: If there is no further discussion, I will say in behalf of the Canadian entomologists that we appreciate very much indeed the address of President Dean, particularly as it relates to the subject of cooperation. At the corn borer conference recently held at Sandusky, Ohio, a large number of entomologists from the United States and Canada met and straightened out many difficulties. This is only one example of what can be accomplished by cooperation.

President Dean resumes the chair.

PRESIDENT GEORGE A. DEAN: The next paper is by C. H. Hadley.

OUTLINE AND PROGRESS OF WORK BEING CONDUCTED AGAINST THE JAPANESE BEETLE, *POPILLIA JAPONICA* Newm.[1]

By C. H. HADLEY, *Riverton, N. J.*

For several years, appropriations have been made annually by Congress and the States of New Jersey and Pennsylvania for the purpose of at first, exterminating the Japanese beetle, and later, when extermination seemed impossible within reasonable expenditures of funds, for limiting the spread of the insect.

The general scheme of organization of the work was outlined in a paper presented by the writer at the annual meeting of this Association a year ago,[2] and the plan of work has been followed during the past year substantially as suggested at that time, with some modifications.

SPREAD

The spread of the insect during the season of 1921 has apparently been considerable. The area infested at the close of the season of 1920 was approximately 103 square miles, of which 92 square miles were in New Jersey and the remaining 11 square miles in Pennsylvania. At the close of the season of 1921, the infestation covered approximately 213 square miles in New Jersey and approximately 57 square miles in

---

(1) Published by permission of the Secretaries of Agriculture of the U. S. Dept of Agriculture and New Jersey Department of Agriculture.

(2) Hadley, C. H., Jour. of Econ. Ent. Vol. 14 (1921) No. 3, pp. 249—253.

Pennsylvania, a total of approximately 270 square miles. While the spread during the past year seems to have been considerable, the infestation as a whole still remains a single compact unit, speaking in terms of area. That is to say, there have not been found as yet any isolated infestations remote from the main infestation. During the past season long distance scouting was carried on throughout the season and over a comparatively large area, but as a result of this scouting no outside infestations were located, Therefore, we believe that the spread to date may be considered to be the natural normal spread of this imported insect in its new environment. On the other hand, in view of the many avenues of distribution open to an insect having the characteristics and habits of the Japanese beetle, it would not be surprising if additional infestations should be found within the next year or two at some distance from the main infestation. During the scouting season it is planned to continue outside long distance scouting and make every effort to locate remote infestations if any occur. In this connection the writer wishes to urge upon all official Entomologists, particularly those located in the States adjacent to the present infested area, the importance of their cooperation in locating and reporting to the Japanese Beetle Laboratory any findings of the Japanese beetle or of insects which they have reason to believe may be the Japanese beetle.

Quarantine

During the past season the quarantine on farm products has been maintained. This quarantine, (No. 48 of the Federal Horticultural Board,) restricts the shipment of farm products and nursery, ornamental and greenhouse products. During the summer of 1921, the product most liable to carry the beetle was sweet corn. Over 200,000 baskets of this product were examined during the summer and over 5,000 beetles removed from the corn. A great deal of time was also spent in inspecting other products but it would appear that the chances of products other than corn distributing the beetles to any great distance are no greater than other avenues of escape which are impossible of control. In view of this fact a revision of the quarantine regulations has been made, effective January 1, 1922. The revised quarantine restricts the movement of sweet corn, lettuce, cabbage, grapes, hay and straw, among the farm crops. The area quarantined for these products comprises the Townships of Palmyra, Cinnaminson, Delran, Riverside, Chester, Mount Laurel, Northampton, Evesham, Lumberton, Westhampton, Burlington, Willingboro, and Beverly in *Burlington County*: City of Camden, Townships of Pensauken, Delaware, Hadden, and Center, and the Borough of Magnolia, in Camden County, in the State

of New Jersey. In the State of Pennsylvania this territory includes Wards 45, 23, 35, and 41 of the City of Philadelphia in *Philadelphia County*: Townships of Bensalem and Bristol in *Bucks County*.

The restrictions placed upon the movement of nursery, ornamental and greenhouse stock, including also soil, compost and manure other than fresh manure, are, we believe, fully as strict as the situation warrants, and it is our intention to make the inspection and certification of these articles sufficiently strict to eliminate as far as is humanly possible every chance of spread of the insect by this means. The area thus quarantined includes that mentioned in the preceding paragraph and in addition in New Jersey; the townships of Florence, Springfield, Easthampton, Medford, and Southampton in *Burlington County*: Townships of Gloucester, Voorhees, Clementon, and Berlin in *Camden County*: Townships of West Deptford and Deptford in *Gloucester County*; in Pennsylvania, Wards 33 and 42 of the City of Philadelphia in *Philadelphia County*: Townships of Cheltenham, Abington and Moreland in *Montgomery County*: Townships of Southampton and Middletown in *Bucks County*.

Biological Investigations

Biological investigations have been and are now being carried on in accordance with the general plan outlined a year ago. Many additional facts relating to the life-history and habits of the insect have been learned. Perhaps the outstanding feature of this work is the fact that, contrary to previous beliefs, the larvae of the Japanese beetle may under some conditions become a serious source of injury. This possibility is fully discussed in a paper being presented at this meeting by Mr. L. B. Smith, who is responsible for the discovery, and it is therefore unnecessary to consider this phase at greater lengths in this present paper.

Further studies of larval habits have also shown that the distribution of this species is not by any means limited to the heavier soil types. Studies of soil types in relation to larval distribution indicate that the insect can and will propagate in practically any soil type represented in New Jersey or Pennsylvania which will support vegetation.

Data accumulated have also substantiated the previous statements regarding the status of the beetle as a leaf eating pest of considerable importance. Briefly it may be said that the potential seriousness of the insect as a pest in this respect is in direct proportion to the intensity of numbers of the insect in any given locality. There has nothing as yet developed to give reasonable grounds for belief that the insect has reached the limits of its capabilities as a pest of orchard and shade trees. Furthermore it also appears that the insect may under some conditions become a pest of some importance to vegetable crops.

That phase of the biological work having to do with the importation and colonization of natural parasites has progressed fully as satisfactorily as was anticipated. Two species of parasites have been received from Japan in quantities sufficient to possibly permit natural colonization another season, providing the material on hand successfully survives the coming winter. One predaceous species received in considerable numbers this year from Japan has demonstrated its ability so far to survive conditions obtaining in the Riverton district and this species will possibly also be colonized the coming season. Reports from our men in Japan indicate that they will be able to supply us with large numbers of at least one and possibly two more parasitic species during the coming season.

Among the native species parasitic upon related insects, it has been learned that some may to a greater or lesser extent, attack the Japanese beetle. Several species of white grub parasites were successfully brought in considerable numbers last spring from Illinois and apparently are suited to conditions existing in the Riverton district, and it is believed that some of them may in time become a factor in the natural control of the Japanese beetle.

Grub Insecticide Investigations

Satisfactory progress has been made in the study of methods of attacking the insect in its larval stages. The fact that the larvae may become a serious menace to lawns, golf courses and other favorable situations, as reported by Mr. Smith, emphasizes the necessity for continuing the investigations now under way toward the finding of satisfactory control measures to meet these conditions.

Comprehensive experiments are also being conducted in an effort to develop a means of freeing from infestation by the grub nursery stock shipped with soil about the roots, such as the various conifers. This is one of the most important ways by which the insect may be distributed long distances, by reason of the fact that it is impossible to satisfactorily inspect such stock without removal of the soil.

Beetle Insecticide Investigations

Considerable progress has been made in the work looking toward the development of satisfactory methods of killing the beetle by means of sprays. A paper presented at this meeting by Messrs. Leach and Brinley of the Japanese Beetle Laboratory reports the use of soap solutions as contact sprays against the beetle. The best results were obtained with the use of a sodium soy bean soap, and under certain conditions a contact spray of this material gives very satisfactory results.

Satisfactory progress has been made in the testing of arsenical spray materials against the beetle, and a paper presented at this meeting by William Moore reports on these investigations. Briefly it may be said that arsenate of lead alone repels the beetle because of the toxic symptoms resulting from the insect eating some of the arsenical. Arsenate of lead alone, because of this fact, does not kill a sufficient proportion of the beetles to result in satisfactory control. In addition to arsenicals various other materials of more or less insecticidal value have been tested out and while a great deal of data has been accumulated and some progress has been made in the development of spray materials other than arsenicals, it is not desirable at this time to make a further report.

Field Work

A considerable amount of large scale experimental spraying has been conducted during the past season and data accumulated on the results. It is believed that during the coming season large scale demonstrations can be carried on to demonstrate the fact that injury from the Japanese beetle can be reduced to a very great extent by proper methods. No further work has been done with large scale control work, such as cyaniding, because of the excessive cost and questionable final value of this type of work.

Summary

To summarize, it may be said that the work under way against the Japanese beetle is progressing satisfactorily. It may be said that the enforcement of the quarantine regulations so far has been presumably effective in preventing long distance spread of the insect, it appearing that the spread so far constitutes the natural spread of an imported insect in a new and exceptionally favorable environment.

The biological investigations including the parasite work have made distinct and important progress. Much additional data have been obtained regarding the habits and reactions of the insect in its present environment, and definite steps toward the liberation and establishment of natural enemies have been made.

The studies and experiments with contact and stomach insecticides for use against the grub and beetle stages of the insect have shown that it is entirely possible to anticipate in the near future practical methods of reducing the actual injury occasioned by this insect to a very considerable extent.

President Dean: The next paper is by William Moore.

THE REACTION OF THE JAPANESE BEETLE TO ARSENICAL SPRAY DEPOSITS[1]

By WILLIAM MOORE, *Riverton, N.J.*

Several years' experience with the Japanese beetle (*Popillia japonica* Newm.) has demonstrated that the adult beetles are "repelled" from the foliage of plants sprayed with arsenicals. Within one or two hours after spraying, most if not all of the beetles which had been present on the plant, have disappeared. During the summer of 1920 and the first portion of the season of 1921, Leach and Brinley conducted experiments which show that this reaction of the beetles is not due to the color, the discontinuity, or the thickness of the spray deposit. The beetles will readily eat plants sprayed with white barium carbonate or lime, black lampblack, orange antimony trisulphide, or greyish brown clay. Clay or lime with coarse size particles was consumed but lead arsenate, ferric arsenate, and zinc arsenate, having in some cases particles so small that the spray deposit could no longer be distinguished on the foliage, acted as repellents.

A crude ferrous arsenate was reported by Davis[2] as having an attraction to the beetles, but the material was found to be non toxic. During the summer of 1920 it was shown that ferrous arsenate precipitated by the use of tri-sodium arsenate was readily eaten by the beetle but proved to be non toxic in cage experiments. Ferrous arsenate precipitated with tri-sodium arsenate contains some ferrous hydroxide which changes over to ferric hydroxide, an antidote for arsenical poisoning. Basic lead arsenate was also found to be eaten by the beetles, but so late in the season that a toxicity test was impossible. In the early part of the season of 1921, basic lead arsenate was tested and found to be practically non toxic to the Japanese beetle.

During the season of 1921 an effort was made to discover why the beetles leave the sprayed plants. Field observations have shown that beetles will feed for a short time upon plants sprayed with acid lead arsenate, ferric arsenate or zinc arsenate, but leave before they have consumed a killing dose. From time to time new beetles will come to the sprayed plants and start feeding, but they also leave before consuming a killing dose. Beetles collected from such plants, and placed in a cage with an unsprayed food plant have lived and acted normally

---

[1]Published by permission of the Secretary of Agriculture, U. S. D. A. and the New Jersey Dept. of Agriculture.

[2]Davis, J. J., "The Green Japanese Beetle Problem", Jl. Econ. Ent., Vol. 13, No. 2, April, 1920. p. 194.

[3]The statements made in the above introductory portion of the paper are largely aken from the unpublished notes of Leach and Brinley during the summer of 1920

for eight days. Lead arsenate precipitated from tenth molar solutions of lead nitrate and disodium arsenate was more readily eaten by the Japanese beetle than ordinary commercial lead arsenate. This lead arsenate consisted of about 25 to 30 per cent. basic lead arsenate and the balance acid lead arsenate. Reducing the amount of lead arsenate from 2 lbs. to 1 lb. per 50 gallons increased the amount of feeding on the sprayed foliage, but the amount eaten was not sufficient to cause death. Freshly prepared ferric hydroxide mixed with lead arsenate, thereby decreasing its toxicity, increased the feeding. Aluminum hydroxide, which would not be as effective an antidote, when mixed with lead arsenate only slightly increased the feeding of the beetle on the sprayed foliage. Lime or lead carbonate, which also decreases the toxicity of lead arsenate by converting some of it to basic lead arsenate, increased the feeding in cage experiments. By using gelatin to coat the particles of the lead arsenate its action was delayed and an increased amount of sprayed foliage was eaten by the beetle. From these observations the conclusion was reached that the beetles were repelled either by the taste of the arsenical or by its toxic effects.

It would appear unlikely that the taste of the arsenical causes the beetles to leave the sprayed plants. If such is the case, then the taste of the arsenical depends upon its toxicity, since the beetles will readily eat arsenicals low in toxicity. Powdered burned alum or quinine were eaten, compounds which are surely far from tasteless. One striking experiment showed that the taste of the arsenical probably did not influence the results. Twenty beetles consumed in six days, all the foliage of a smartweed sprayed with the strychnine sulphate at the rate of 2 pounds to 50 gallons. Not a single death resulted. Twenty beetles in six days ate very little of the foliage of a smartweed sprayed with strychnine arsenate at the rate of 2 pounds to 50 gallons, but six of the beetles died. It would require a very discriminating taste to distinguish between strychnine sulphate and strychnine arsenate.

Arsenic is classed as an irritant poison. Almost the first symptoms in higher animals are vomiting and profuse and painful diarrhea. The withdrawal of water from the body results in thirst and a dryness of the mouth and throat, making swallowing difficult[1].

To what an extent these symptoms are developed in the Japanese beetle is unknown, but beetles which have consumed a killing dose or close to a killing dose of arsenic suffer from diarrhea. Should the reaction in the beetle to arsenic poisoning be similar to that in higher animals, pain would be a prominent symptom. A compound which

[1]Sollman Torald—A Manual of Pharmacology—1917, p. 739.

would relieve the pain should increase the feeding of the beetle to a point where it would be killed. Morphine sulphate would be the most logical material to produce this result, but apparently it has no effect since, when used at a concentration as high as 10 pounds to 50 gallons of the spray, there was no marked improvement in the feeding of the beetles. Atropine sulphate, chloral hydrate, aspirin, diethyl-barbituric acid, sodium bromide, lead bromide, and sodium salicylate, were all tested without striking results.

Attention was next directed to that group of substances classed as intestinal sedatives. Bismuth subcarbonate is used on inflamed surfaces, and as an intestinal sedative in cases of diarrhea. This substance was tested in a cage experiment at the rate of 1 pound to 50 gallons of the spray mixture containing 2 pounds of lead arsenate. One hundred per cent. of the beetles were killed in 4 days compared with 12—14 days for lead arsenate alone. The action of bismuth subcarbonate is not due to any specific effect of the metal but largely the mechanic action of the compound in coating over the mucous membranes. The basic salt of a cheaper metal might therefore be substituted for the bismuth. Zinc subcarbonate gave fair results in cage experiments and was then used in a field test. Beetles collected from the sprayed plants one hour after spraying, and placed in a cage with an unsprayed plant, did not feed for 12—14 hours, showing that they had consumed nearly a killing dose of the arsenical.

Coating the particles of lead arsenate with some material which would slow down its action was next tried. Lead arsenate coated with lead oleate, lead stearate, zinc stearate, or lard gave good results in cage experiments. It was necessary to use these materials as dusts since it was difficult to "wet" the particles with water. A small area of smartweed was thoroughly dusted in the field with lead arsenate coated with lead stearate, and the beetles closely observed and collected as they left the plants. At the end of two hours the beetles still present on the plant were collected and the whole collection placed in a cage with an unsprayed smartweed. Within 48 hours 86.2 per cent. of the females and 61.5 per cent. of the males died. Later experiments demonstrated that if the plants are very carefully dusted with lead arsenate alone, that the beetles may be killed. The leaves of the plants must be whitened with the pure lead arsenate by driving the dust directly on the leaves. Lead arsenate or calcium arsenate allowed to settle upon the foliage from a dust cloud will not result in a killing.

These results show that to kill the beetle, one must have either a large quantity of lead arsenate present on the foliage, or have the lead arsenate coated in such manner that its action is delayed, so that in the period of time elapsing between the first bite and the development

of the first symptoms of the poison, the beetles have consumed a killing dose. Based upon this idea sprays were prepared containing 5 lbs. of lead arsenate to 50 gallons plus 1 to 5 lbs. of flour, gelatin, or glue to coat over the particles and delay the action of the arsenic. These sprays spread evenly over the foliage covering the surface with a large dose of coated particles of lead arsenate. Using sprays and collecting the beetles as they left the plants, a kill of 60 to 70 per cent. was obtained under field conditions. Collections of beetles in the field after spraying may be divided into several groups.

First:—Beetles which have not fed on the sprayed foliage, of these from 20 to 40 per cent. of the males and 0 to 20 per cent. of the females will die, probably due to poison they obtain from cleaning their bodies and in particular their mouth parts while the spray is drying.

Second:—Beetles which after feeding fly away within 30 minutes from the time of spraying. In this group 40 to 70 per cent. of the males and 60 to 80 per cent. of the females die.

Third:—Beetles still on the plants 1 to 2 hours after spraying of which, from 50 to 70 per cent. of both males and females die.

In conclusion, the season's work may be summed up as having shown that the Japanese beetle is repelled by the toxic effects produced by having eaten some of the sprayed foliage; that a certain percentage of beetles may be killed under field conditions by the use of large quantities of the arsenical evenly distributed over the foliage; and that in the case of sprays, the even distribution of the arsenical may be obtained by the use of flour, glue, or gelatin, which materials by coating the particles of the arsenical probably increase their efficacy. Whether the use of an arsenical will be successful for large scale control in the field remains to be determined during the coming season.

Summary

Japanese beetles are not repelled from sprayed foliage by the color, physical condition, or taste of the arsenical.

The beetles appear to be repelled by the toxic symptoms resulting from eating some of the arsenical.

Large quantities of the arsenical evenly distributed over the foliage will result in a certain percentage of the beetles eating a killing dose before the toxic symptoms develop.

A certain percentage, particularly of the males, die without having eaten of the sprayed foliage, probably due to spray material obtained in cleaning their bodies and mouth parts.

President George A. Dean: These papers on the Japanese Beetle are now open for discussion.

MR. GLENN W. HERRICK: Is powdered arsenate of lead less effective in controlling this beetle than arsenate of lead in liquid form?

MR. WILLIAM MOORE: I did not mean to leave that impression. We have more or less passed by the dust because it gives uncertain results. One can get one result one day and another result the next. The dust when applied by the cloud method only covers a portion of the leaf surface, and fails to kill. The beetle fails to eat a sufficient amount before it leaves the plant.

MR. R. L. WEBSTER: Have you specific data on the grams of arsenate per square meter of leaf surface?

MR. WILLIAM MOORE: I have not at the present time. We intend to determine it during the coming season.

MR. N. F. HOWARD: Our results with the Mexican bean beetle corroborate Doctor Moore's, especially in the case of lead arsenate. In confinement, adults placed on sprayed plants are more easily poisoned in spring and summer than late fall, when very low percentages are poisoned. This does not apply to the larvae however.

PRESIDENT GEORGE A. DEAN: The next paper on the program is by G. E. Sanders and A. Kelsall.

CHEAPER ARSENICALS AND THEIR USE

By GEORGE E. SANDERS AND A. KELSALL,
Insecticide Investigations, Entomological Branch, Ottawa

In considering cheaper arsenicals, we can pretty well confine our attention to arsenate of lime and white arsenic, since arsenic, in the form of arsenate of lime varies in cost from one-half to three-fourths of that in the form of arsenate of lead or Paris green, while arsenic in the form of white arsenic, varies in cost from one-seventh to one-tenth of that in the form of arsenate of lead or Paris green.

One or the other of these two cheap arsenicals can be substituted for the more expensive ones for the most ordinary purposes, with the exception of—(1) Lead hydrogen arsenate for straight spraying and dusting on tender foliage, and for combining with sulphur dust. (2) Neutral lead arsenate for use on the most tender foliage, and for use in lime sulphur solution where arsenate of lime gives injury when combined with it.

ARSENATE OF LIME

This material dusts and sticks better than Paris green, is much safer on foliage, and with the exception of its use in paint should wholly replace that well known material.

Arsenate of lime is unsafe when used straight, or in combination with dusting sulphur, on apple, and other tender foliage. With these exceptions arsenate of lime is either equal or superior to lead hydrogen arsenate for the ordinary uses to which that poison is put.

There has been a great deal of controversy as to the comparative values of lead hydrogen arsenate and arsenate of lime in lime sulphur solution. Different experimenters have reported results that are at variance, yet I have no doubt but that all of the results were fairly reported. From our experience backed by chemical investigations, differences in the time that elapses between the adding of the poison and the application of the spray and differences in climatic conditions may throw the advantage as regards arsenical injury either way. If the spray is applied immediately the poison is added, lead arsenate will usually prove the safer. Weather that will cause the spray to dry rapidly also gives an advantage to lead arsenate. Over a period of years, arsenate of lime has given us a slightly safer combination with lime sulphur than lead arsenate. A small quantity of excess lime makes both somewhat safer in a lime sulphur solution. In using arsenate of lead, the greatest safety is obtained by adding about two pounds of hydrated lime to one pound of dry arsenate of lead in water before adding to the lime sulphur solution. In using arsenate of lime, two or three pounds of hydrated lime should be used to each pound of the arsenate of lime. Both may be dumped directly into the lime sulphur solution.

One of the places where arsenate of lime is superior to all other arsenicals now on the market, is in the alkali sulphide and poly-sulphide solutions. In Nova Scotia, a large proportion of the apple growers have, since they abandoned lime sulphur, used a sodium poly-sulphide solution for the calyx spray. There we worked out the following formula which has proved highly successful under Nova Scotian conditions:—One pound soluble sulphur or one quart sulfocide, one-half pound arsenate of lime and five pounds of hydrated lime to each 40 Imperial (50 wine or U. S.) gallons of water. Increasing the amount of arsenate of lime by one-half in this formula, is safe under most conditions.

In all types of Bordeaux mixture, we have found arsenate of lime safe, efficient and very convenient. While white arsenic may be used in Bordeaux mixture at a still lower cost, it is questionable if small growers or those who have to trust the mixing of their spray chemicals to poor types of labor, can find an arsenical that would in any way be more satisfactory than arsenate of lime.

In Nova Scotia, about two-thirds of the arsenate of lime used on apples is applied in copper arsenic dust which is made up for the apple of eighty-five pounds of hydrated lime, ten pounds of finely ground

dehydrated copper sulphate and five pounds of arsenate of lime. Some seven hundred tons of this dust was used on the apple in the Annapolis Valley last season and there is no doubt but that there will be an enormous increase in its use in 1922. A few tons of copper arsenic dust containing. twenty pounds of dehydrated copper sulphate, eight pounds of arsenate of lime and seventy-two pounds of hydrated lime, were used on potatoes during the past year. We have found arsenate of lime absolutely safe, efficient and satisfactory in every way in this type of, what we term mixed copper arsenic dusts.

In addition to the above mentioned uses, arsenate of lime is the best of all arsenicals for straight dusting on such crops as potatoes, cotton etc.

White Arsenic

The base from which practically all arsenicals are manufactured, is of course infinitely lower in cost than any of its products.

We entomologists in the past have for the most part regarded white arsenic simply as white arsenic and have not paid sufficient attention to fineness, the effect of impurities, texture and source of our material. In working out the formulas that I will describe later, we found it almost impossible to get samples of white arsenic from different sources that gave exactly the same reactions.

The experiments of Davis and Turner[1], and Ford and Larrimer[2], show that the metallic arsenic in the white arsenic used by them was a less efficient insecticide than the arsenic in Paris green. We have been using generally a super-fine dust white arsenic, that is caught in a special baghouse, by the Deloro Smelting and Refining Co. In grasshopper baits, this material we have found, is superior to Paris green on an arsenic basis.

In our opinion the efficiency of white arsenic as an insecticide in baits is primarily a matter of fineness; purity being a minor consideration. It must be said here that freedom from impurities will almost as readily decrease as increase the toxic value of white arsenic.

During the past three years, a considerable number of farmers in the Maritime Provinces have been using white arsenic as a poison in Bordeaux mixture. In 1919 and 1920, this was confined to the potato, but in 1921, it was used with entire success on the apple in the 3–10–40 Bordeaux that is generally used on the apple there.

Briefly, the formula for using it is, mix one pound of quickly reacting super-fine white arsenic with one pound of hydrated lime and mix

[1]Experiments with cutworm baits by John J. Davis and C. F. Turner. Canadian Entomologist Vol. L, No. 6, pp. 127—192.

[2]Some factors influencing the efficiency of grasshopper baits. A. L. Ford and W. H. Larrimer. Journal of Economic Entomology Vol.14, No. 3. pp. 292—299

this mixture in ten Imperial (13½ wine or U. S. A.) gallons of water, and in this suspend a sack containing ten pounds of crystal copper sulphate. Stir occasionally until the copper sulphate is dissolved. This poisoned stock solution of copper sulphate is used in the same manner as a straight solution of copper sulphate, diluted and added to a lime solution that is equally diluted. This formula in the 4–4–40 and 5–5–40 used on the potato and in the 3–10–40 used on the apple, has given satisfaction wherever used in the proper amounts per acre. In certain cases where only one-half as much spray as should be applied was used or where the application was delayed until the potato beetle larvae were more than half grown, some complaints were made, but where instructions were followed excellent results were obtained.

The mixture of equal parts of super-fine quick re-acting white arsenic and hydrated lime is now on the market in Nova Scotia, in two pound packages.

We have recently developed a method of using white arsenic in one of the copper arsenic dusts. Following the success of the dust made up of dehydrated copper sulphate, hydrated lime and arsenate of lime both in pest control and low cost, an opportunity developed of still further reducing the cost by using burned lump lime in place of hydrated, finely crystalized copper sulphate in place of the dehydrated, and white arsenic in place of arsenate of lime. This formula reduces the already low cost of copper arsenic dust by around two dollars per hundred pounds.

During the past season, we made around one ton of the white arsenic, lump lime, crystal copper sulphate dust and the results from it were so satisfactory that the Cooperative Fruit Companies intend manufacturing an experimental batch of fifty tons, for their members testing in 1922. Whether the manufacture of this dust gravitates to insecticide concerns, cooperative companies or large growers, the saving will be the same since the method allows them to use the white arsenic direct, the reactions that go to make it safe being obtained by only a trifling manipulation.

We have found it most important to get white arsenic that is adapted to our needs. There is, as we have already stated the widest difference in quickness in reacting, fineness and texture in different lots of material. Fineness does not always indicate speed in reacting. For all of the purposes that I have outlined, a quick reacting material is superior; it must also be of even fineness and capable of passing a screen of 200 meshes to the inch or finer. Some of our most satisfactory samples have, independent of fineness, shown a fine texture or fluffiness that is usually an indication of a quick reacting material. So far as our work

is concerned purity is a secondary consideration. The most satisfactory material that we ever used runs only ninety-four per cent arsenious oxide.

Conclusion

In addition to the above, there are doubtless many other uses to which these low priced arsenicals can be put. The study of lower priced remedies is an important branch of Entomology, for the finding of a means of controlling an insect or a disease is of little value if the material available as a remedy costs more than the damage. The cost of treatment in proportion to the value of controlling pests varies. Some apple spraying and dusting costs from twenty to thirty per cent of the gross value of the control while occasionally potato spraying will cost as low as five or even three per cent of the gross value of the control.

We know of hundreds of insects and diseases that could easily be controlled, but which generally are left undisturbed on account of the cost of control approaching or even exceeding the value of the damage done and every reduction in cost of materials or methods of treatment moves some of these pests from the class that cannot be profitably combatted into the class that can be profitably controlled.

President George A. Dean: Mr. T. J. Headlee will now present a paper,

---

SOME FURTHER EXPERIENCE WITH CONTACT DUSTS[1]

By Thomas J. Headlee, Ph.D. and W. Rudolfs, Ph.D.[2]

Introduction

The writers are not attempting in this paper to set forth a finished piece of work but, in view of the large interest now existing in contact dusts, have thought it well to give an account of some data obtained both from the field and the laboratory in the hope that such action might help to hasten the day when the actual worth of contact dusts is known. The senior author was led to undertake these studies because of the tremendous demand on the part of potato growers for a dust method of controlling the pink and green aphis (*Macrosiphum solanifolii*) of potato and tomato.

---

[1]Paper No. 73 of the Journal Series, N. J. Agricultural Experiment Stations, Department of Entomology.

[2]The chemical determinations have been made by Dr. Rudolfs, who since Sept. 16, 1921 has been filling the position of Bio-Chemist in Entomology at the N. J. State Agricultural Experiment Station.

All mixtures were made at the laboratories. The clay referred to is in all cases Milltown Ball Clay No. 9, dried and ground to a mesh mostly exceeding 200. This is a more or less colloidal clay mined locally and so far as the writers know not reliably analyzed. The calcium oxide referred to is in all cases the best grade of Palmer selected stone lime ground to about 200 mesh. The grinding machines employed were the common ball mills used in ceramics. The nicotine in all cases is derived from "Black-leaf 40." The calcium hydroxide referred to is in all cases a good grade of commercial hydrated lime. The Sanders' dust was secured from Riches, Piver & Co., and consisted, according to the manufacturers, of dehydrated copper sulphate, calcium arsenate and inert ingredients. The nicotine was introduced into the particular dust mixture concerned and ground in in the ball mills above referred to.

Two sets of investigations form the subject of this paper. They are concerned with the determination of the following points:—

(1) The relative effectiveness of nicotine delivered as a dust and as a liquid spray;

(2) The disadvantages of nicotine delivered as a dust as compared with nicotine delivered as a spray;

(3) The advantages of nicotine delivered as a dust over nicotine delivered as a spray

(4) The relative value of different dusts as carriers for nicotine.

The field work was devoted entirely to the pink and green aphis of the potato and tomato, while the laboratory work was concerned with the rate and the amount of nicotine delivered from the different dust carriers.

Table I will serve to set forth the data relative to the killing power of nicotine delivered as a dust and as a spray and will serve to show some of the disadvantages of dust as compared with spray.

TABLE I.—TABLE SHOWING THE RELATIVE EFFECTIVENESS OF NICOTINE DELIVERED AS A DUST AND AS A SPRAY AND THE LENGTH OF PERIOD OVER WHICH THE KILL EXTENDS WHEN NICOTINE IS USED AS A DUST. TESTS WERE MADE ON M. SOLANIFOLII ON AMERICAN GIANT POTATOES.

Date of treatment	Composition of the dust % Clay	CaO	Bl. L. 40	Nicotine	No. of lbs. per acre	Method of applying
6/23, 1921	86.7	8.6	4.7	1.88	50	Niagara Engine duster
6/23, 1921	88.8	8.8	2.4	.96	50	Niagara Engine duster
	water	soap				
6/25, 1921	98.8	1.0	.23	.09	100 gals.	Engine potato sprayer
6/25, 1921	98.5	1.2	.3	.12	100 gals.	Engine potato sprayer
6/25, 1921	98.5	1.2	.3	.12	100 gals.	Engine potato sprayer

Hours of treatment and % killed					
First Count		Second Count		Third Count	
Hours	% killed	Hours	% killed	Hours	% killed
24	46.6	48	87.0	72	76.3
24	32.7	48	83.8	72	69.3
2	78.2				
24	84.6				
24	85.1				

The above table serves to show that a 2% nicotine clay calcium oxide dust kills 87% of the plant lice, while under the same conditions nicotine delivered as a spray kills very slightly over 85%. It also shows that a 1% nicotine clay calcium oxide dust kills nearly 84%. This table shows that nicotine dust kill reaches its maximum between 24 and 72 hours after application, while nicotine delivered as a spray reaches a high point of kill within the first 24 hours after application and that the vast bulk of its kill is accomplished within the first 2 hours. If rain falling within the period covered by the kill of the dust should promptly put an end to the nicotine dust activity this long period of kill would be a decided disadvantage to the employment of nicotine dusts. As a matter of fact a 1.88% nicotine clay, calcium oxide dust destroyed about 87% of the aphis within an exposure of 48 hours, and a 3.64% nicotine clay calcium oxide dust destroyed 66.6% of the aphis after an exposure of 8 hours at which time a heavy rain fell. When we take into consideration the fact that with a percentum of nicotine 1.76% larger the kill is 20.4% less when rain interfered, we are compelled to conclude that rain coming within the period of kill constitutes a very serious interference with the effect of nicotine delivered as a dust.

Experience covering several years in the application of nicotine as a spray shows that using a mixture composed of 1½ pints of "Black leaf-40," 8 pounds of soap and water to make 100 gallons, the acre cost for lice treatment should, with the present cost of nicotine, range from $3.50 to about $4.00. The cost may be distributed as follows, not taking into consideration the machine charge;—Nicotine $2.34 (wholesale) or $2.91 (retail), soap 40c, man labor 50c, horse labor 25c, total $3.49 or $4.06. Experience has shown that to get a kill with nicotine delivered as a dust comparable to that obtained with nicotine delivered as a spray, from 30 to 50 pounds of material is necessary per acre. The cost of dusting will, therefore, range from $4.75 to $7.50, depending upon the amount of dust used per acre. The cost may be distributed as follows;—Dust material 30 pounds to the acre $4.50 or 50 pounds to the acre $7.50, man labor 17c, horse labor 8c, total $4.75 or $7.70. In making these calculations on both dust and spray it is assumed on the basis of experience that one man and a team together with the proper machinery can spray 8 acres a day or dust 24 acres a day.

It thus appears that nicotine delivered as a dust suffers from two serious disadvantages—rain falling within the period of kill (the first 72 hours) seems greatly to reduce if not entirely to stop the work of the nicotine dust, and the application of nicotine in a dust form at strengths sufficient to make it as effective as the same substances delivered as a spray costs much more per acre.

The advantages of nicotine delivered as a dust over nicotine delivered as a spray are mainly concerned with the speed at which the acreage can be covered and the freedom from the necessity of securing water supply nearby.

The disadvantage of nicotine delivered as a dust as above set forth must in all probability be met primarily through discovering a carrier which will deliver the nicotine at a more rapid rate and in larger amounts, or through the discovery of a carrier which will by attaching itself more closely to the body of the insect render the nicotine which it does deliver more effective, or through the discovery of a carrier that will operate along both these lines.

Table 2 will serve to show the results of certain field tests made with different carriers.

TABLE II.—TABLE SHOWING THE EFFECT OF CERTAIN NICOTINE DUSTS ON MACROSIPHUM SOLANIFOLII ON AMERICAN GIANT POTATOES AND ON TOMATOES

Date of treatment	Material	%	Material	Composition of Material %	Dusts	%	Material	No. of lbs. % per acre
6/23, 1921	Sanders' dust	97.6			Bl. L. 40	2.4	Nicotine	.96 25
"	Clay	88.8	CaO	8.8	"	2.4	"	.96 50
7/27, 1921	"	84.4	"	9.3	"	6.3	"	2.52 50
"	$Ca(OH)_2$	77.5	"	15.5	"	7.0	"	2.8 50
"	Clay	78.4	$Ca(OH)_2$	14.7	"	6.9	"	2.76 50

Method of applying	Hours after treatment and % killed						Remarks
	Hours	%	Hours	%	Hours	%	
Niagara Engine Duster	24	4.	48		72	62.6	No rain
" " "	24	32.7	48	83.8	72	69.3	" "
" large hand "					60	64.7	Light rain 6 hours and heavy rain 30 hrs. after treatment
" " "			48	59.3			Heavy rain 8 hrs. after treatment
" " "			48	19.0			Heavy rain 8 hrs. after treatment

In dealing with the pink and green aphis on potato and tomato it seems useless to consider a higher percentage of nicotine than 2% because the cost of the material becomes impracticably high. There is, however, no doubt that as the charge of nicotine is increased the kill of the lice also increases within the limited period, but the increase in kill is not in proportion to the increase in cost. This fact is shown in Table 3.

TABLE III.—TABLE SHOWING EFFECT ON M. SOLANIFOLII OF INCREASING NICOTINE STRENGTHS AND OF INCREASING THE CaO USED ON TOMATOES

Date of treatment	Composition of dust				No. of Lbs. per acre	Methods of applying.	% killed	Hours of treatment	Remarks
	Clay	CaO	Pl. L. 40	Nicotine					
7/27, 1921	83.6	9.4	7.0	2.8	50	Niagara large hand duster	64.7	48	Light rains in 6 hrs. and heavy rains 30 hrs. after treatment
7/27, 1921	76.4	14.5	9.1	3.64	50	" " "	66.6	48	Heavy rain 8 hrs. after treatment
7/27, 1921	71.1	17.8	11.1	4.44	50	" " "	79.7	48	" " " " "
7/27, 1921	62.4	24.3	13.3	5.32	50	" " "	87.8	48	" " " " "

Improvement in nicotine delivered as a dust must apparently be sought not in the direction of increasing nicotine percentages but in better utilization of the 2% or less which comes within the range of reasonable practice. With this point in view the determination of the rate and amount of nicotine delivered from different carriers was undertaken. Ten grams of each of the nicotine impregnated dusts were placed in a glass container and a stream of air conditioned to 80° F and 73% relative humidity drawn through the dust at the rate of one liter per minute. The results of this work, insofar as the work was complete at the time of the preparation of this paper are set forth in table No. 4.

TABLE IV.—TOTAL PERCENT NICOTINE GIVEN OFF IN HOURS. (ALL MIXTURES IMPREGNATED WITH 2% NICOTINE)

No.	Mixture								
1	Clay	Percent	0.17	0.35	0.74	1.14	1.48	1.94	
		Hours	24	48	96	144	192	240	
2	Clay + 5% CaO	Percent	1.08	2.74	4.22	6.04	8.32	10.1	
		Hours	23	41	89	137	185	133	
3	Clay + 5% Ca (OH)$_2$	Percent	1.03	3.21	4.50				
		Hours	19	59	72				
4	Ca (OH)$_2$	Percent	2.70	5.41	11.46	14.19	16.81		
		Hours	23	45	91	115	139		
5	Ca(OH)$_2$ + 5% CaO	Percent	3.82	9.92	15.96	22.46	27.87		
		Hours	16	40	65	89	11		
6	Sanders' Mixture	Percent	1.65	3.36	7.75	12.44	15.63		
		Hours	24	48	72	96	120		
7	Sanders' Mixture + 5% CaO	Percent	.627	4.22	7.86	10.716	13.68		
		Hours	14	38	62	86	110		
8	50 Clay + 50 CaO	Percent	1.37	5.30	9.69	13.23	16.49	18.91	20.51
		Hours	5	21	45	69	93	117	141
9	50 CaO + 50 Ca(OH)$_2$	Percent	2.22	7 18	13.85	19.26	24.28	28.44	
		Hours	5	21	45	69	93	117	
10	CaO	Percent	2.96	7.64	16.47	20.63	25.31	28.78	
		Hours	5	21	45	67	91	115	

Examination of this table will serve to show the mixtures giving off nicotine in an ascending series as follows;—

Clay, Clay + 5% Calcium oxide, Clay+5% Calcium hydroxide, Sanders' Mixture, Sanders' Mixture + 5% Calcium oxide, Calcium hydroxide, Calcium hydroxide + 5% Calcium oxide, Clay + 50% Calcium oxide, Calcium hydroxide + 50% Calcium oxide and Calcium oxide.

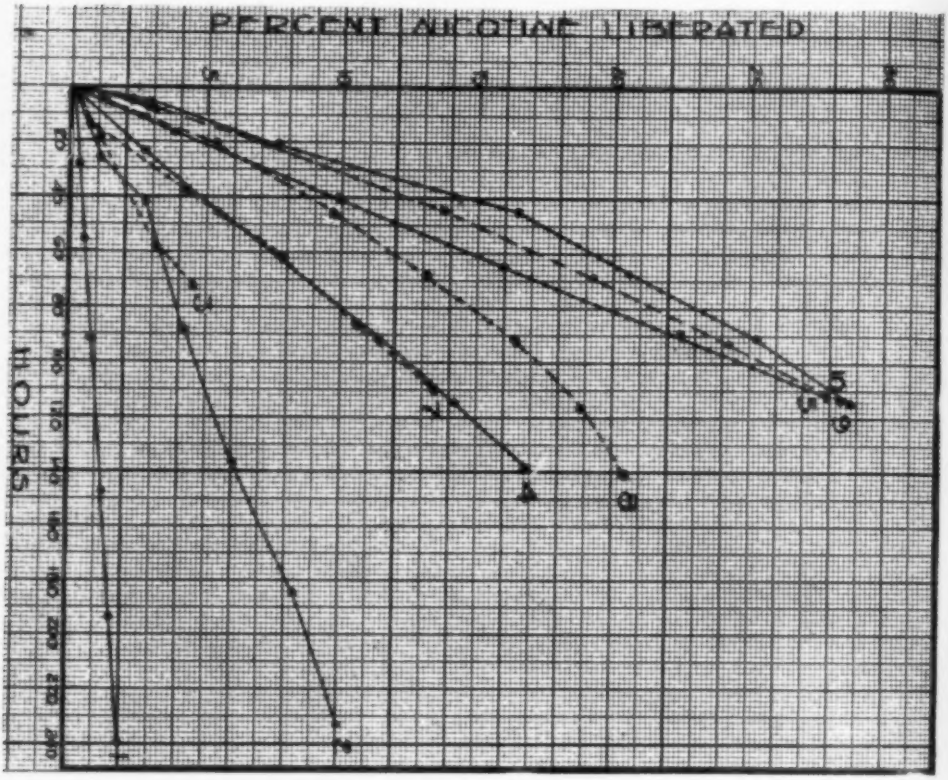


Fig. 1. Diagram showing percent nicotine liberated after definite periods. Legend: 1 = Clay; 2 = Clay + 5% CaO; 3 = Clay +5% $Ca(OH)_2$; 4 = Ca $(OH)_2$; 5 = $Ca(OH)_2$ + 5% CaO; 7 = Sanders' mixture +5% CaO; 8 = Clay + 50% CaO; 9 = $Ca(OH)_2$ + 50% CaO; 10 = CaO.

Two striking features appear in these tests—the first is found in the fact that none of the mixtures throw off 25% of the nicotine within the first 72 hours, or the period of kill. The second is that the clay Calcium oxide mix throws off only about 4% of its nicotine within the period of kill and in spite of that fact seems to be one of the most effective mixtures tried in the field. Of course, in the field tests the amount of calcium oxide used was at least 8½% instead of 5% used in the laboratory tests.

Summary

The following conclusions may be drawn from the data contained in this paper;—

(1) That proper dust carriers impregnated with a 2% nicotine are as effective in control of the pink and green aphis on potatoes as is nicotine delivered in a liquid form;

(2) That nicotine delivered as a dust has the following disadvantages—

(a) The period of kill is much longer than that necessary for nicotine delivered as a liquid, thus rendering the work of the dust liable to serious interference by rainfall;

(b) The cost of controlling aphis with nicotine dust is materially larger than the cost of controlling it with nicotine delivered as a liquid.

(3) That the advantages of nicotine delivered as a dust are primarily concerned with the increased speed in covering large acreages and the freedom from the necessity of a nearby water supply;

(4) That there occurs in all carriers, with which the writers have experimented, a tremendous waste of nicotine;

(5) That the improvement of nicotine dust is to be sought in the more rapid evolution of the 2% or less of nicotine, which is within the range of reasonable practice, or in the delivery of such nicotine as is evolved in close contact with the bodies of the lice, or in developing along both these lines.

Mr. William Moore: Last year I pointed out that nicotine may be absorbed by clay. Professor Headlee's work proves that this actually occurs. His results apply to his clay, but not to other clays. I have on my desk 6 or 8 different clays; one from Professor Headlee, another from Professor Sanders, etc. I have been testing them in different ways, not particularly from the standpoint of nicotine, but in other ways. Professor Headlee's does not absorb nicotine as much as some of the other materials. The most interesting clay from our point of view is one from Georgia; I have 2 vials here that I will pass around. They have both the same nicotine content made up according to one of Professor Headlee's formulae and contain calcium oxide. In the light-colored clay, if you will smell it, you will find little or no odor of nicotine. There is 2% there but you cannot smell it. The other sample is Professor Headlee's clay, and the odor of nicotine is quite noticeable. The white clay comes from the south and ties up the nicotine tight, even in the presence of calcium oxide.

Mr. W. E. Britton: I would like to ask Dr. Headlee if he has tried it with potatoes?

MR. T. J. HEADLEE: No. We tried it last year with apples.

PROFESSOR GEORGE A. DEAN: The next paper is by P. J. Parrott.

CONTROL OF SUCKING INSECTS BY DUSTING

By P. J. PARROTT, *Geneva, N. Y.*

Among the problems of pest control that confront the orchardist and general farmer, those bearing on dusting continue to attract attention. In a previous report the writer presented an outline of the scope and nature of his activities with respect to dusting, and announced some preliminary results relative to the effectiveness of materials in powdered form in controlling certain injurious insects. The present paper summarizes the results of experiments in continuation of previous work, considering especially the susceptibility of apple red bugs and various species of aphids.

THE APPLE RED BUGS

In the experiments with the bright red bug (*Lygidea mendax* Reuter) and the dark red bug (*Heterocordylus malinus* Reuter), dusting mixtures containing 0.25, 0.50, 1.0, and 2.0 per cent nicotine, respectively, were toxic to the insects. The preparations with the highest amounts of nicotine gave, on an average, more uniform results and displayed higher killing power than those containing the smaller ratios. Mixtures with 0.25 per cent nicotine are probably too weak to obtain satisfactory control. Dusts containing 0.5 or more per cent nicotine should be used in rather liberal amounts and applied with care to destroy the majority of the insects and to avoid high dosage cost. Prevailing conceptions of dosage requirements for typical bearing orchards tend to underestimate the quantity of material necessary to accomplish effective results.

Efficient dusting mixtures against red bugs require a larger nicotine content than spraying mixtures, which makes the dosage cost for dusting higher than that for spraying. Dusting requires less time than spraying, resulting in appreciable economies in time and labor. At prevailing prices for materials dusting is more expensive than spraying. Considering the needs of average growers and cost of labor and materials, the apple red bugs can be more effectually and economically controlled by spraying than by dusting. In large commercial orchards dusting could doubtless be used to great advantage in a supplementary capacity to the usual spraying operations.

The Currant Aphis

Dusting and spraying experiments with the currant aphis (*Myzus ribis* Linnaeus) were conducted in a planting of 500 currant bushes, which provided for 100 plats of 5 plants each, thus permitting frequent tests of the different materials. The spraying mixture was composed of 1 pint of nicotine sulfate to 100 gallons of water to which were added 6 pounds of soap. The dusting preparations contained 0.50, 1.00, and 2.0 per cent nicotine, respectively, sulfur-lead arsenate (90–10) being used as the carrier of the nicotine. Each plat received three treatments, dusting material being applied at the rate of 1 pound per bush, and the spraying mixture at the rate of 2 gallons per bush.

Both dusting and spraying mixtures afforded efficient protection. All the treated plants contrasted strongly with the untreated plants, which displayed numerous discolored and distorted leaves that began to drop during midsummer. The foliage of the treated plants was more abundant and adhered to the plants long after the checks had been completely defoliated.

The dusting preparations showed a high rate of toxicity to the currant aphids. The condition of the foliage containing 0.5 per cent nicotine was not quite as satisfactory as that of the vines dusted with preparations containing 1 and 2 per cent nicotine, respectively. A small percentage of the leaves showed injury, but the curling was not of the severe type exhibited by the checks, and there was little, if any, premature defoliation.

The Cabbage Aphis

The experiments with the cabbage aphis (*Aphis brassicae* Linnaeus) provided for tests with dusting and spraying mixtures with different ratios of nicotine, in which all available types of machines for applying liquid and powdered insecticides were used. Soap and nicotine at standard strength, sulfur-lead arsenate (90–10) and lime dusts, containing 0.5, 1.0, and 2.0 per cent nicotine respectively, were toxic to the cabbage aphis. Two applications gave excellent control, resulting in yields of cabbage which were from 4 to 6 tons per acre according to the kind of treatment in excess of those of the check plats.

From the standpoint of economy and effectiveness, the most satisfactory treatment was a lime preparation (calcium hydrate) containing 2.00 per cent nicotine, applications being made at the rate of 20 pounds per acre with a "hand bellows duster." With power dusting machinery, from 35 to 40 pounds of material were required to secure effective control. Considering the results as a whole, dusting appears to be a very promising system of treatment for controlling the cabbage

aphis. It has made a strong appeal to leading cabbage growers in this area who heretofore have been very lukewarm towards spraying as a method of combating the aphis. In the immediate vicinity of the experiments it has been estimated that dusting materials to the value of approximately $8,000.00 were applied to cabbages.

For the control of cabbage aphis and cabbage worms we prefer, for the present, the formula which provides for 5 pounds nicotine sulfate, 15 pounds of powdered lead arsenate or calcium arsenate, and 80 pounds of hydrated lime. If the caterpillars are not very numerous, it is believed that the arsenical may safely be reduced to 10 pounds.

The Potato Aphis

Of the various insects considered in our experiments, the potato aphis (*Macrosiphum solanifolii* Ashmead) was the most difficult species to combat satisfactorily. It is apparently not as susceptible as the foregoing forms to common insecticides, and the dense foliage and matting of the vines constitute formidable obstacles to effective treatment which can only be overcome by painstaking work.

On the basis of the insects infesting the tips of the growing shoots, dehydrated copper-lead arsenate, containing 2 per cent nicotine, killed 52.3 per cent of the aphids at a dosage of 50 pounds per acre, and 83.2 per cent at a dosage of 90 pounds per acre. Nicotine and soap, using 100 gallons per acre destroyed 85.5 per cent of the aphids.

Notwithstanding the fact that many insects in some of the plats escaped, it should be noted that all the applications checked appreciably the rapid development of the aphids on the growing tips of the vines, which seemed to afford noticeable protection to the leaves. The plats that were left untreated displayed much discolored, withered foliage as the result of the uninterrupted feeding and breeding of the aphids. And one unacquainted with the plans of the tests had little difficulty in distinguishing the untreated plats from the treated plats.

Conclusions

In view of the data obtained from the foregoing experiments it is concluded that apple red bugs and certain aphids may be effectively controlled by thoro dusting with sulfur-lead arsenate or calcium hydrate containing nicotine sulfate. The outstanding advantage of dusting is speed of operation which effects noticeable economies in time and labor. A serious drawback is the high cost of the preparations, due chiefly to the large amount of nicotine required to make effective mixtures. Notwithstanding the economy in time and labor, dusting on the basis of existing prices for materials and labor has generally been more expensive than spraying, except possibly in the treatment of cabbages.

One means of effective economy is to employ mixtures with the minimum amount of nicotine necessary to secure satisfactory control. The experiments as outlined indicate that for certain species of insects lower ratios of nicotine may be used than now generally prevail. Of vital importance in furthering an extensive employment of dusting for the control of sucking insects is the need of less expensive materials which function effectively as contact insecticides.

MR. GLENN W. HERRICK. These experiments are interesting to me as they point out clearly that in nearly any spraying operation, a certain number of the insects escape, no matter how thoroughly you may carry on the work. The efficiency of almost any insecticide in the field seems to depend in the final analysis on the effectiveness with which it is applied

PRESIDENT GEORGE A. DEAN. The next paper on the program is by J. S. Houser and C. R. Neillie,

---

AN ACCOUNT OF THE SUCCESSFUL USE OF THE AEROPLANE IN DUSTING TALL TREES INFESTED WITH LEAF EATING CATERPILLARS.

BY J. S. HOUSER AND C. R. NEILLIE

(Withdrawn for publication in National Geographic Magazine, March, 1922.)

MR. E. G. KELLY. What is the expense of this machine?

MR. J. S. HOUSER. The greatest item of expense lies in the original cost of the plane, but when you consider that a Curtis plane can in these times be procured for fifteen thousand dollars, and that some of the liquid spraying machines used in New England cost five thousand dollars and over, the comparison is not so much out of the way, after all. The work that one can do in a day's time with an aeroplane equipped as was ours, or equipped as a real machine for the work should be equipped, will greatly exceed that of a liquid sprayer. Thus the saving in time and labor would more than offset the original excessive cost of the machine.

MR. F. C. CRAIGHEAD. What is your idea of the best wind conditions for application?

MR. J. S. HOUSER. We used a crossing wind. Under other conditions you might want to fly directly into the wind. We found in our trial flights at McCook field that we could get an excellent spread of the poison by flying into the wind, and that would allow one to fly higher than otherwise.

MR. F. C. CRAIGHEAD. How far to the side did you fly?

MR. J. S. HOUSER. Fifty-three yards from the grove, and the dust covered the windward and leeward side as well. I might have said that the wind was blowing at the rate of eight to eleven miles an hour. The grove was three hundred and twenty-five feet wide.

MR. F. C. CRAIGHEAD. How far beyond the grove did the poison extend?

MR. J. S. HOUSER. Particles carried from five to eight hundred feet beyond, but most of it settled in the grove.

MR. F. C. CRAIGHEAD. With one application can you cover a strip five hundred feet wide?

MR. J. S. HOUSER. Three hundred and twenty-five feet—and then some drifted on over. The farthest distance of drift I should say was perhaps one thousand feet.

MR. W. C. O'KANE. I want to ask whether there were any indications that any of the caterpillars died from the wilt disease. I have seen heavy infestations by the maple worm enormously reduced inside of 48 hours by this disease. The conditions of infestation and the heavy defoliation of the trees as shown on the slides indicate conditions that would be favorable for an outbreak of the wilt disease.

MR. J. S. HOUSER. I have no evidence that this disease was present in this case. An examination of caterpillars of the same species on trees nearby that were not sprayed showed that they were perfectly healthy, although the conditions as to defoliation were the same.

SECRETARY A. F. BURGESS: I am very glad to have heard this paper. Last summer Mr. Houser invited me to witness the test, but it had to be started a few days earlier than was planned, and I did not have sufficient time so that I could be present. The information given is exceedingly interesting, but we should remember that it was carried on under conditions which seem to be extremely favorable for aeroplane work. The ground on which this small area of catalpa trees were growing, was very level, and there were many places nearby where a perfect landing by an aeroplane could be made. Most forest conditions are not as favorable. The weather was apparently favorable, while on large scale spraying operations much adverse weather conditions would probably be encountered. This is not a criticism of the experiments, although I do not believe results similar to these can be duplicated under all woodland conditions. In the gipsy moth work where a large amount of woodland spraying is done, the country is rough and uneven and I believe it very doubtful whether similar results could be secured. The statement made by Mr. Houser concerning the spraying of pasture and corn, is very interesting. I do not believe wholesale dusting of this type could be carried on without encountering many complaints from owners of

pastures. I hope further experiments with aeroplanes will be continued. It is a good line to follow up, but there will be many practical difficulties to overcome before aeroplane spraying will be brought to a state of perfection where it will be practical in rough forest areas.

In regard to the wilt disease, from the amount of defoliation of these catalpa trees and the rapid death of the caterpillars, I have a suspicion that some wilt disease was present.

MR. J. S. HOUSER. The catalpa sphinx is a rather watery, flabby caterpillar and begins to decay very soon after death. This, I think, explains the reason why the breakdown of the caterpillars was so rapid. I believe it was the spraying that was responsible for their death.

MR. WILLIAM MOORE. What was the material you used?

MR. J. S. HOUSER. Powdered arsenate of lead.

MR. H. A. GOSSARD. I was present at the time this work was conducted, and I would say, regarding the question of wilt, that these caterpillars were not starving at all. There was abundant young foliage on the trees the day the dusting was done. We climbed those trees after the work was done, to the tops of them, and branches were brought down. I really didn't do the climbing but I received some of the branches that were brought down, and the amount of dust that was on them and on everything in the grove made us expect that those fellows would begin to wilt—but not with wilt disease. There wasn't a sign, the day I was there, of any disease with those caterpillars. They were there in abundance and were healthy and were feeding at a great rate. Three days later, Mr. Houser made a report that about ninety-nine per cent. of them was dead.

I think these questions are entirely proper but I don't think anyone who was present and saw the work done, would have any suspicion at all that a bacterial disease attacked those caterpillars. It was something else.

PRESIDENT GEORGE A. DEAN. The next paper is by Mr. D. M. De Long.

THE BOOM-NOZZLE SYSTEM AND THE TRACTION DUSTER AS FACTORS IN GRAPE LEAF HOPPER CONTROL

By D. M. DE LONG, *Ohio State University*

The Grape Leaf hopper (*Erythroneura comes* Say) has been a very serious pest in the Erie-Chautauqua grape area along the southeastern shore of Lake Erie for many years. The attacks of these minute insects during several successive summers may be so inconspicuous that the growers may be inclined to regard the pest as a factor of diminishing importance in grape growing, and they are always hopeful that it will

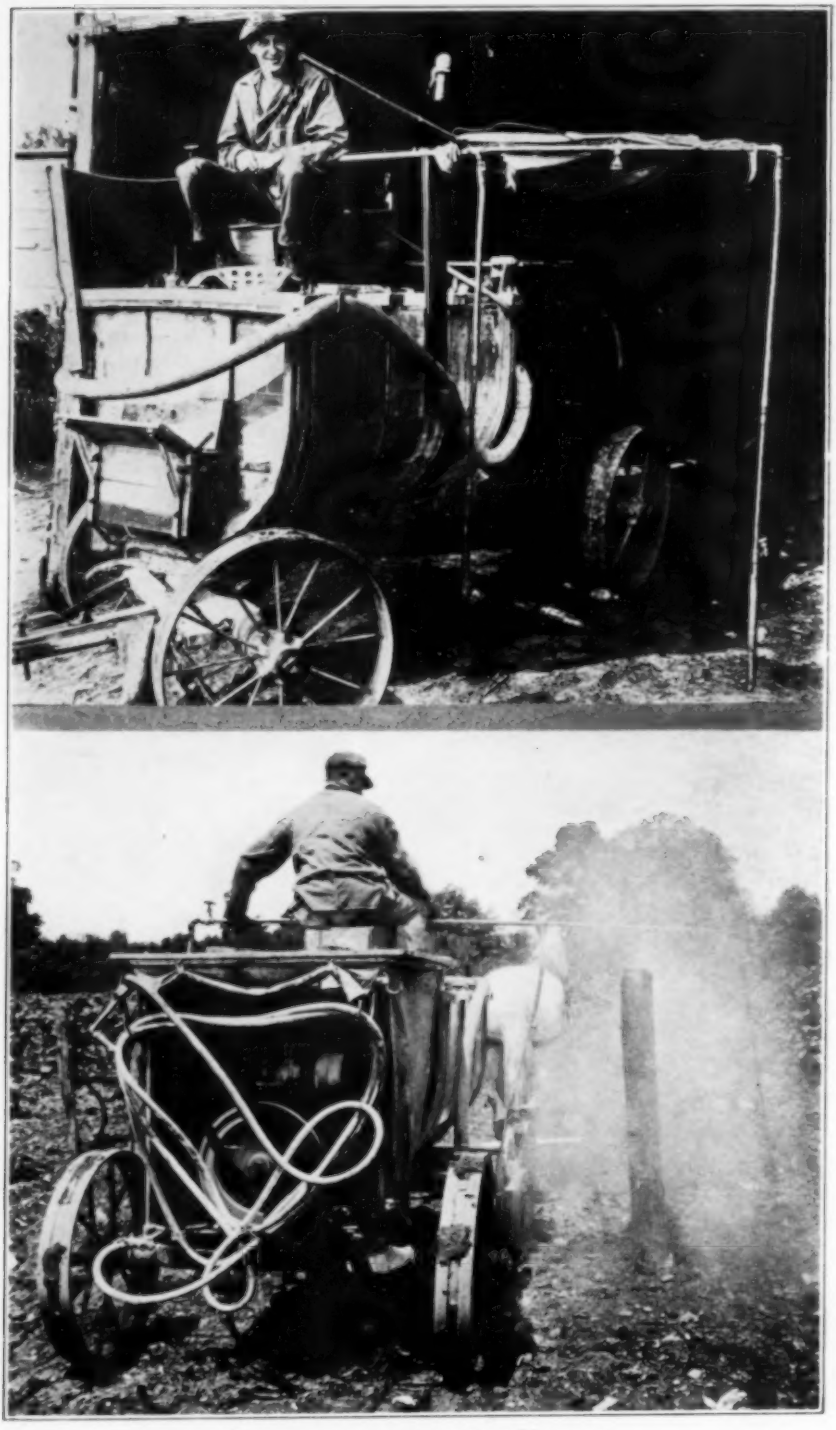
gradually disappear as a pest; but frequently the following season will favor the growth and development of vast numbers of hoppers, which the grower is generally unprepared to combat.

During the seasons of 1920 and 1921 the hoppers have caused great damage to hundreds of acres of grapes in this section, and naturally the areas most severely attacked were those closely approximating woodlands. The serious damage caused by these pests can be realized more fully when it is known that foliage severely attacked dried prematurely and curled up before the grapes had ripened. Consequently many growers were refused markets for their grapes in 1920 at the Welch grape juice plant on account of the red appearance and sour flavor of the partially ripened fruit.

Many of the growers with a large acreage of grapes were totally unprepared to spray when the nymphs appeared in great abundance, and the leaves began to turn yellow. One of the most progressive growers stated that he had neither sufficient length of time, nor enough men to spray with the customary trailer nozzles, and that if he attempted to do so other fruits must go unsprayed. Furthermore, a large percentage of the hoppers would become adults by the time the spray could be applied.

For many years attempts to combat the Grape Leaf hopper and Grape Berry moth with the customary "set nozzles" have been made with varying success. In the old type of sprayer the nozzles are so arranged that the halves of two rows are sprayed simultaneously, thereby permitting the hoppers to escape from the row by way of the unsprayed portion, many of them flying to safety before the spray. In this type the nozzles were set horizontally to the vine on vertical rods at either side of the tank. This arrangement of nozzles had a tendency to push the leaves downward instead of exposing and treating the under surface where the hoppers usually feed.

The boom system with the arrangement of nozzles for spraying one row at a time from both sides and above has been previously used but the nozzles in that case were placed horizontally to the vine and machines were being delivered to the growers in that condition in 1921. Furthermore the lower nozzle was two or three feet above the ground when the spray was applied and the nozzles were all set in the same plane. In view of the unsatisfactory results obtained from this type of set nozzle a rearrangement of nozzles was devised which has given very satisfactory results. This arrangement permitted the operator to be seated on the spray tank holding a $\frac{5}{8}$ inch horizontal pipe about seven feet long, connected with the spray tank and extending over the top of the row. From this horizontal piece of pipe a three foot pipe connected by three feet of rubber hose extended vertically almost to the ground on either side of the row at a distance of about three and one-half feet apart.



BOOM ARRANGEMENT OF SET NOZZLES

Upper—Showing arrangement of five nozzles for spraying both sides of row simultaneously. Lower—Cloud of spray enveloping grape row.

At first seven disk nozzles were used. One was placed so as to point downward from the horizontal pipe, midway between the vertical pipes, and directly over the grape row. Three nozzles were placed on each vertical pipe, one at the extreme lower end pointed upward at an angle of about 45 degrees, another about a foot and one-half above directed upward and slightly backward, and a third about three feet from the bottom directed upward and slightly forward. The nozzles were fitted to the vertical pipe by means of "T's", and an "Ell", which sufficed in the case of the extreme lower one. The principal disadvantage encountered at the start was the spreading of the vertical pipes on the application of pressure from the pump, preventing a thorough application to the foliage. This was readily overcome by a weight at the end of each vertical pipe, and fully as good results were finally obtained in spraying by removing the upper nozzle on each vertical pipe, leaving only five nozzles arranged as described above.

Three things are important in the construction. First, the lower nozzle should be as close to the surface of the ground as possible, as the lower portions are frequently most heavily infested by the nymphs; second, the nozzles should be upturned at an angle of approximately 45°, but this will vary with the vineyard and a difference of 5° will often cause a 15 to 20% difference in the killing; third, the lateral nozzles should be alternated slightly forward and backward.

The driving spray from the up-turned nozzles raises the leaves and covers the under surface thoroughly, while the nozzle above the vine covers the upper surface. Under sufficient pressure a perfect mist was obtained by this arrangement of nozzles, and observations of the leaves just after spraying proved that the greater percentage of immature hoppers had been hit and killed by the spray.

In the vineyard where this experiment was carried on, the undersides of the leaves were almost covered with hopper nymphs, and an excellent chance was afforded to try out this apparatus on a large acreage.

Comparing the two types of "set nozzle grape sprayers" the boom system has certain advantages over the old type; first, the thorough treatment of one row at a time, enveloping both sides of the vine in a fine driving mist offering little opportunity for either nymphs or adults to escape to safety; second, the up-turned nozzles lift the leaves and thoroughly cover the under surfaces. As compared with the trailer system the economic factors of time and expense are important. It requires more than twice as long to spray with trailer nozzles than to cover the same area twice with the boom system and an extra man is necessary to operate the trailer nozzles. In other words the extra 5 to 10% killed by the trailer system costs as much as the first 80 or 85% which can be obtained by the boom system and is an economic control.

A PRELIMINARY REPORT OF DUSTING FOR CONTROL[1]

The traction duster has been used the past season in an attempt to control the grape leaf hopper. A 2% nicotine dust was used with both Bordeaux and lime. Applications on different plots varied at the rate of from 20 to 75 pounds per acre and it was only at the rate of 60 pounds per acre or more that a decided killing of both adult and nymphal stages was secured. Scarcely a live hopper could be found in some plots and dead leaf hoppers were observed in great abundance under the vines. On other plots treated on the following evening with apparently the same material and the same amount there was only a small per cent of killing. For this reason it is very hard to state what condition caused the killing. The different results obtained may be due entirely to the temperature and humidity conditions and there may have been a difference in the percentage of nicotine in the mixture.

Although a large amount of experimentation will be necessary to determine the conditions of killing, the interesting fact is that an economic control has been obtained by the dust on some plots.

PRESIDENT GEORGE A. DEAN. The next paper is "Derris as a Promising Insecticide," by R. W. Wells, F. C. Bishopp, and E. W. Laake.

DERRIS AS A PROMISING INSECTICIDE[2]

By R. W. WELLS, F. C. BISHOPP and E. W. LAAKE,
United States Bureau of Entomology

There is a distinct demand for an insecticide for use on domestic animals which can be applied in the dry or dust form and be depended upon to give satisfactory control. This is especially true in regard to the control of lice on live stock. The various species of lice seldom become sufficiently numerous to be of marked importance as parasites, except during the winter when the conditions are least favorable for the application of liquids. In an effort to meet this need the authors and their associates have tested a considerable number of dry insecticides under varying conditions and against various external parasites. Among the substances tested was powdered derris. The insecticidal properties of this material were brought to the attention of American entomologists by Messrs. N. E. McIndoo, A. F. Sievers, and W. S. Abbott.[3] As shown by these authors this material has some promise both as a contact and as a stomach poison for insects.

[1]All materials used in the trial were furnished by the Niag ara Sprayer Co. through the kindness of Mr. F. J. Sutton.

[2]Published by permission of the Chief of the Bureau of Entomology.

[3]Derris as an insecticide, Journal of Agr. Research, vol. 17, No 5, pp. 177—200, August 15, 1919.

In our tests of the substance when applied externally on animals and fowls we have seen no indication of any poisonous effects to the host. It is also stated that in factories where the roots are being powdered the employees become covered with the dust and experience no ill effects whatever. It is certain, however, that with a material so toxic it is necessary to proceed rather cautiously until we know more about its effects on the higher animals and man.

The powdered derris roots used in our tests were kindly furnished by the Tobacco By-Products & Chemical Corporation, and is supposed to be from *Deguelia* (*Derris*) *elliptica*.

Experiments With Derris Against Mallophaga

In our tests of this material against Mallophaga we treated chickens infested with seven species of lice and cattle infested with the common biting louse of that host (*Trichodectes scalaris*). Where chickens were rather thoroughly dusted with derris the lice were very quickly destroyed, practically all of them being dead the day following treatment. Subsequent examinations extending over a period of six weeks showed no live lice present, thus indicating that the eggs were killed or the young lice destroyed upon hatching. Derris was also tested in suspension in water by Mr. H. P. Wood. Over forty fowls were dipped in a bath containing one-fourth ounce of powdered derris to one gallon of water. Subsequent examinations showed that a few lice were still present on the first and second day after treatment but soon after this all live lice disappeared and none were found on several subsequent examinations. In another test derris was used at the rate of one ounce to three gallons of water. Two and one-half hours after dipping some dead lice were found but a few living ones were present for about two weeks, when all disappeared.

Derris Against the Common Biting Louse of Cattle

A number of experiments were carried out with the dusting of cattle with derris diluted with various amounts of carriers. In the preliminary experiments at Dallas, in which the authors were assisted by Mr. H. P. Wood and Mr. E. E. Wehr, the results against this species were not very satisfactory, but these rather indifferent results were chargeable in a measure to the fact that the calves were not thoroughly dusted. In one test three heavily infested animals were treated with derris and tobacco dust, equal parts, the latter containing about .1% nicotine. The material was applied at the rate of 12.3 grams per animal with a dust can. On the following day all but a few scattered lice were dead. Subsequent examinations showed the presence of a few live nymphs only, thus indicating that probably all adults were destroyed but some

of the eggs escaped destruction. Unsatisfactory results were secured with the use of 8.6 grams per animal of derris and tobacco dust (one to ten) on four other hosts. Five heavily infested calves were treated by dust gun with 3.5 grams per animal of derris and wheat flour (one to three). Four days later a few living lice in all stages were still present. Derris and flour in proportion of one to five was applied with a dust gun on seven additional calves on Feb. 14, the infestation ranging from light to heavy. The final examination of these animals was made on March 9. Four of them appeared to have all lice destroyed while two showed a very few living lice and one a moderate number.

Three animals were treated Feb. 14 and 15 with derris and flour (one to twenty) applied with a shaker can. About one ounce of the mixture was used per animal. On March 9, one of these was completely free of living lice and a few were present on the other two. Five animals were dusted with a hand atomizer on Feb. 14 and 15, using derris and flour in proportion of one to ten, 16.2 grams per animal. On Feb. 16 very few live *T. scalaris* were observed and on March 1 and 9 but a single immature specimen was found alive.

Owing to the fact that sodium fluoride has been shown by us to be very effective against *T. scalaris* when applied in the dust form, and with a view to developing a powder which would be one hundred percent efficient against all lice on cattle, a mixture of equal parts of derris and sodium fluoride was dusted with a gun on 16 calves and yearlings on Feb. 24. About one and three-sixteenths ounces were used per animal. On March 9 and on subsequent dates not a single live louse could be found upon thorough examination.

On May 18, 1920, two calves which were heavily infested with *T. scalaris* were treated at Lafayette, Indiana, with pure derris powder, one ounce per animal applied with a dust gun. All lice were observed to be dead on May 22 and the eggs were apparently killed. On June 5 no living lice were found and all of the eggs appeared to be dead and collapsed. Three other moderately infested calves were treated by shaker can with derris and flour, equal parts. Two received one ounce each and the other one and one-half ounces. Four days after treatment all lice and eggs were apparently killed, and on June 5 not a living specimen was found.

Use of Derris Against Anaplura

The use of derris has been given a fairly extensive test against two of the common sucking lice of cattle, namely *Linognathus vituli L.* and *Solenopotes capillatus* End.

On Feb. 15, 1921, seven calves, most of which were heavily infested with *L. vituli*, were treated. Two of these received derris and flour

one to five, one ounce per animal applied with a gun. Three received derris and flour one to ten, 16.2 grams per animal applied with a gun, and two derris and flour one to twenty, 28.75 grams per animal applied with shaker can. These calves, with the exception of one treated with the 1 to 10 mixture, were examined on Feb. 24. All of the lice were killed on the animals treated with the 1 to 10 and only a few were found on one of those treated with the 1 to 20 mixture. All of the others had a few living specimens present although some of them were weak. On Feb. 24, 1921, 16 calves, most of which were lightly infested with *L. vituli*, were treated with sodium fluoride[1] and derris equal parts with a gun. On March 9 and subsequent dates not a living louse could be found and the eggs were collapsed. At Lafayette, Ind. two heavily infested calves were dusted with pure derris and three with equal parts derris and flour, applied with a shaker about one ounce of powder per animal. Examinations made four and eighteen days later showed no live lice and all eggs collapsed.

On Feb. 14, 1921, two calves with a moderate infestation of *S. capillatus* were dusted with one ounce of a mixture of derris and flour, one to five, with a dust gun. Two days later one of these showed a few alive and the other about fifty percent killed. On March 1, both were apparently free from lice and all of the eggs appeared to have hatched or collapsed. On March 9, however, a group of lice was found near one of the ears. On Feb. 14, a calf was treated with one ounce of derris and flour, one to twenty with a shaker can. Two days later no live lice were found and examination on March 1 showed no living specimens, but several were found to be alive when the animal was examined on March 9. Six calves, each with a light infestation of *S. capillatus*, were treated on Feb. 14 with derris and flour, one to ten, 16.2 grams per host with a dust gun. On March 1, only two living specimens could be found, and on March 9 no adults were present, but several half grown lice were seen. A cow showing a heavy infestation of this species was thoroughly treated with derris and flour in equal parts by means of a shaker on March 1, one and three-fourth ounces of the mixture being used. On March 9 a thorough examination indicated that the lice were completely destroyed. All eggs were either hatched or collapsed.

All of the calves in these tests were associated with other animals and the re-occurrence of specimens in some cases indicates that the animal may have been reinfested from other stock.

A test with derris and flour one to one was made on a dog heavily infested with the sucking louse, *Linognathus setosus* Olfers. The anima l was given a thorough treatment with one ounce of the mixture with

[1]Sodium fluoride has been found to have practically no effect on this species.

shaker can. Examinations two days after dusting and subsequently failed to reveal the presence of adults or young, thus indicating complete destruction. Three other infested dogs were dusted with much smaller amounts and all lice and eggs killed. The minimum amount tried on the above hosts was about two grams of a mixture of derris and corn starch (one to three).

Preliminary Tests With Derris Against Larvae of Hypoderma lineatum

A preliminary test of the use of an ointment consisting of one part derris to two parts vaseline applied to the holes of warbles in the backs of cattle indicates that this ointment is as effective as any other material used in this way. Five days after treatment all grubs were found to have been killed and the condition of the cysts was very satisfactory. A wash consisting of one pound derris, four ounces soap and one gallon water applied once with a brush to the backs of infested cattle killed practically all grubs.

Use of Derris Against Fleas

Results from the use of derris against dog and cat fleas were surprising and extremely gratifying. A series of tests were carried out by Mr. H. P. Wood in a dog and cat hospital in Dallas. Dr. Allen Foster, the proprietor, very kindly cooperated in this work. Both dog and cat fleas (*Ctenocephalus canis* and *Ct. felis*) were present.

In the first test which was begun Oct. 28, 1918, three dogs were given a thorough treatment with undiluted derris with a dust gun. On the following day a single living flea was observed. On repeated examinations extending up to Nov. 10th no more living fleas were found despite the fact the dogs were associated with other infested individuals.

Four dogs of three breeds were given a thorough but rather light dusting with derris undiluted and no live fleas were found on them two days later.

A series of tests with several breeds of dogs indicated that the minimum dosage necessary to completely destroy all fleas was .87 grams of a mixture of equal parts derris and corn starch per animal. When the quantity of derris was reduced to .2 grams one hundred percent kill was not realized.

Following these preliminary experiments derris and corn starch in the proportion of 1 to 3 was applied to all of the animals in the hospital at the time—48 dogs and 9 cats. The material was put on along the back and neck of each animal with the thumb and finger. An average of slightly less than two grams per animal was applied. These animals were treated on Dec. 4 and subsequent examinations up to Dec. 10 showed no living fleas.

In order to determine the results of the use of derris on dogs which were not removed from their flea-infested quarters, treatment was begun on three heavily infested animals. Dust was applied on all parts of the animal at the rate of one-half to two and one-half grams. In the case of one of these dogs all fleas disappeared after the second application and none were found subsequently. Probably the cool weather of December held the breeding in check, however. In the other tests live fleas were found about a week after each treatment and the number gradually increased until the next application was made. Three treatments, however, reduced them to comparatively few and the tests were discontinued.

Several cats were treated with about three pinches of derris each. No injury whatever was observed to the hosts and the fleas were all destroyed, although where the cats had freedom some living fleas were picked up a few days after the application and apparently remained on the host.

In one test puppies rather heavily infested with the sticktight flea (*Echidnophaga gallinacea*) as well as the dog and cat fleas, were each treated with one gram of undiluted derris. In a few hours dead dog and cat fleas began dropping off the hosts and the following day all specimens were dead, though many sticktights remained attached.

Summary and Conclusions

Derris powder is satisfactory as a destroyer of Mallophaga on chickens and cattle, but apparently not quite as effective on the latter as sodium fluoride.

It is very effective against Anoplura on cattle and dogs, one treatment accomplishing the destruction of all stages.

The results of its use against fleas on dogs and cats are probably most striking, very small amounts being sufficient to destroy all fleas present.

It appears to be effective for lice and fleas when reduced with from one to ten parts of a carrier to one part of derris.

Mr. H. A. Gossard: Where can we obtain derris commercially?

Mr. F. C. Bishopp: There is no commercial supply now available in this country, but I believe, with a demand for the product, that it will be put on the market. I understand that an English chemical company is now producing it in the East Indies, and furnishing it as an insecticide in South Africa. It is said that they are in position to supply a considerable quantity of it. I don't know that the supply

would be sufficient for all needs that may be created in time, but I am convinced that the production can be greatly increased, with the demand.

MR. H. A. GOSSARD: What does it cost?

MR. F. C. BISHOPP: It costs about a dollar a pound, but perhaps it could be produced considerably cheaper.

MR. L. O. HOWARD: How does this compare with pyrethrum?

MR. F. C. BISHOPP: With nearly all of the pyrethrum group, in the case of fleas at least, there is that stunning property which causes the fleas to come out and drop off, while with derris we get actual destruction of them. Of course the destruction of the insect is important and in that derris is very effective.

MR. N. F. HOWARD: Derris appeared to be superior to a good grade of pyrethrum against the Mexican bean beetle; however, we are not recommending either of these materials for practical use against this insect.

PRESIDENT GEORGE A. DEAN: The next subject is "The Apple Sucker," by W. H. Brittain.

THE APPLE SUCKER

(*Psyllia mali* Schmidberger)

By W. H. BRITTAIN, *Provincial Entomologist for Nova Scotia*

PRESENT DISTRIBUTION

The present known distribution of the apple sucker includes, Austria, Caucasus, Czecho-Slovakia, England, Ireland, Germany, the central and northern part of old Russia, Norway, Sweden, Denmark, Holland and lastly Nova Scotia, where its presence was first detected in 1919. It has also been recorded from Japan and France, but at the present time it is not known to be present or injurious in either of these countries. It is apparently found as far north as the apple will grow and seems to be most serious and abundant throughout the northern range of its host.

HOST PLANT

The insect is recorded as breeding on the European Mountain Ash (*Sorbus aucuparia*) and it occasionally attacks pear and more infrequently quince. From a practical standpoint, however, the apple may be considered the sole host. The fact that it has been reported from a long list of other plants is doubtless due to the habit of the adult insect of seeking shelter on other trees than its real host.

Character of Injury

The injury is almost entirely the work of the nymphs, as the adults do no appreciable damage. Both leaves and blossoms are affected, the latter most seriously, since the insect prefers the blossom clusters for food. Badly infested blossoms shrivel and die and remain hanging to the injured trees for some time. The injury due to these creatures seems, however, to result entirely from the amount of sap withdrawn from the blossoms, there being an entire absence of that "poisoning" effect, that seems to result from the punctures of certain Miridae.

Injury to the foliage falls in four general categories:—

1. Brown withered leaves that may remain clinging to the trees throughout the summer.
2. Green leaves that are sometimes shed in showers about the end of June in infested orchards, apparently due to the work of this pest.
3. Yellow leaves which may begin to fall in mid-June and continue for several weeks.
4. Similar injury to No. 3, but greatly aggravated, which seems to result from spraying injured trees with Bordeaux mixture or dusting them with copper-lime-arsenate dust. The work of the insect seems to render the foliage particularly susceptible to spray injury of this kind and orchards so treated sometimes present a much worse appearance than those left unsprayed.

The insects may be present in large numbers without causing much apparent damage and we are as yet unable to predict what place it will eventually occupy as an apple pest.

Life History

The first emergence of nymphs from the eggs takes place when most varieties of apple are in the so-called "mouse ear" stage, but on very late opening varieties such as Northern Spy, the buds may not have even begun to burst. On the other hand the leaves of the Transcendent Crab are well expanded. The insect hatches first on the earliest opening varieties, there being a difference of as much as four or five days between Gravenstein and Northern Spy, but the emergence does not correspond perfectly, by any means, with the state of development of the buds. The entire hatching period may extend over eleven days. In 1921 the first individuals emerged just one week later than those of *Aphis pomi* De G. and just eleven days previous to those of *Lygus communis* Knight.

The nymphal stage lasts from thirty-one to thirty-six days, the emergence of other adults reaching a maximum about six days after the first individuals are seen and continuing for about eight days thereafter.

Mating takes place within two weeks after emergence and is observed throughout the remainder of the season, but no eggs are laid until late August or September and oviposition continues until freezing weather.

The female prefers the wood of bearing trees upon which to lay her eggs, mostly upon the smaller fruit spurs or shoots. They are not laid with any regularity, but occur with great frequency on the unevennesses of the spurs, around bud-scale scars, among the pubescence of the young growth however. They are sometimes found, but much less often and in much less abundance, upon nursery stock.

Habits

The young on hatching immediately penetrate the buds and seek the axil of the unfolding leaf where they remain until almost fully grown, when they may be found in the open ranged along the flower stalk, petiole or lower side of the leaf. They secrete a copious amount of clear, sticky fluid, which is surrounded by a whitish, opaque, waxy material secreted by a group of pores around the anus. This is often seen in the form of a thread with a globule at the end protruding from the insect's body. In severe cases it drips from the trees on men or horses passing beneath.

The adults feed but little and do no apparent injury. They have a tendency to spread out onto shade or forest trees surrounding the orchard until the acutal number in the orchard is greatly reduced, but return again to deposit their eggs. Orchards sprayed in the spring are soon reinfested by adults flying in from surrounding untreated orchards.

Natural Enemies

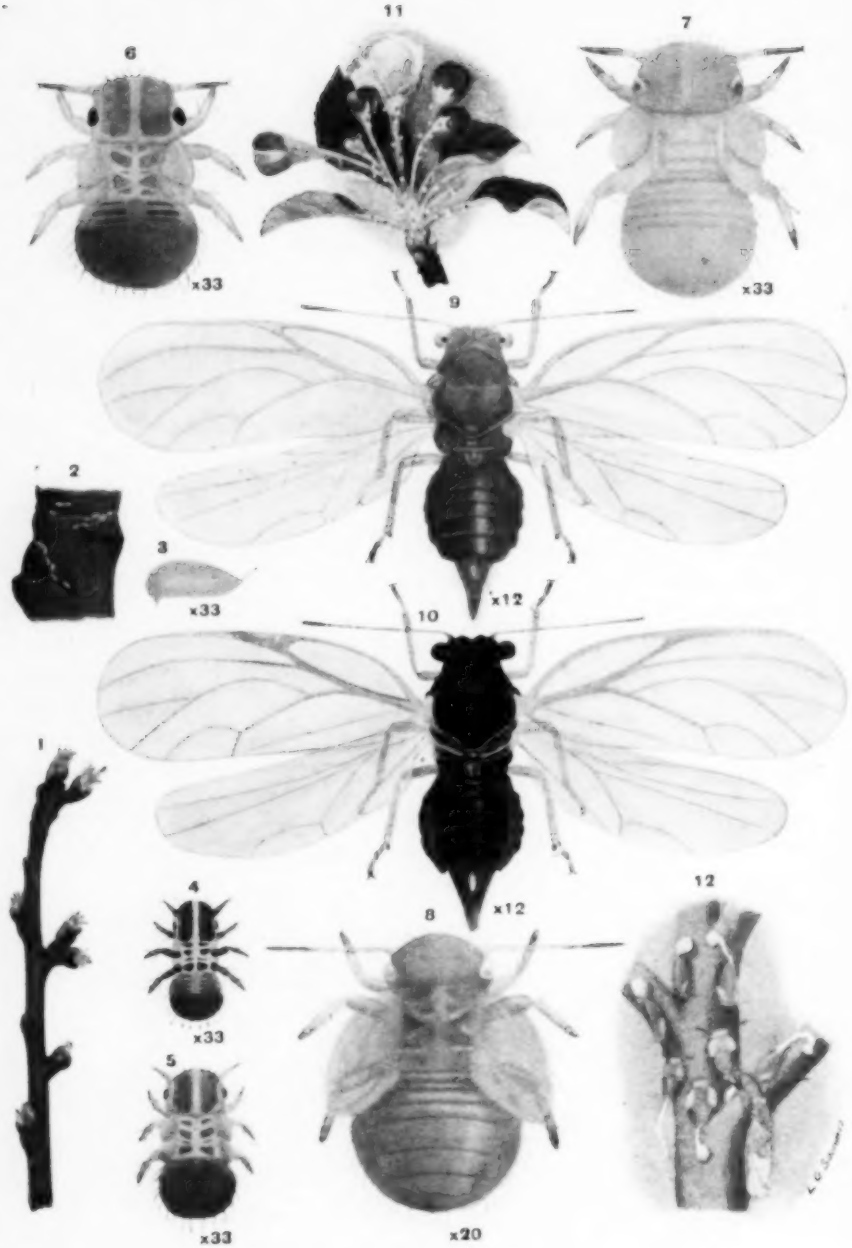
No parasites are known, but numerous predaceous enemies, such as birds, ants, aphis-lions, etc. account for a certain number. This loss, however, is from a practical standpoint, insignificant.

A fungous disease (*Entomophthora sphaerosperma*) has proven much more effective over limited areas, practically wiping out the insect in certain orchards. The disease started in 1920 in a few very heavily infested orchards at the point of original discovery of the pest and was only effective in a few orchards immediately contiguous.

Control

The control experiments may be considered under two headings:—

1. The treatment of nursery stock to destroy the eggs.
2. The control of the insect under orchard conditions.



THE APPLE SUCKER

(PSYLLIA MALI SCHMIDBERGER)

PLATE A

1, Twig showing condition of buds at time of hatching; 2, eggs on a small section of apple twig; 3, single egg (x33); 4, 5, 6 & 7, represent the first four stages of the nymph or immature insect (x33); 8, the fifth stage (x20); 9, adult female, summer coloration (x12); 10, the same, autumn coloration; 11, blossom cluster infested with nymphs and showing honey dew and wax secreted by insect; 12, greatly enlarged portion of young shoot, showing nymphs and one adult in place.

THE TREATMENT OF NURSERY STOCK. The necessity of finding some suitable treatment to be given imported nursery stock known to be infested or suspected of being infested with the eggs of these pests, is one that occurs immediately to any official entomologist.

Fumigation with hydrocyanic acid gas carried on in exactly the same way as for the San Jose Scale, with exposures varying from 1 hour to 10 hours, have been conducted for the past two seasons. Those during the past season, though on a much larger scale then the previous one, are far less satisfactory, because not only a very large percentage of eggs failed to hatch on our check trees, but the hatching was also very irregular.

However, the final result of all our work is to show that while a single hour's exposure to hydrocyanic acid gas destroys a very large percentage, and in some cases all, of the eggs, some individuals have survived an exposure of nine hours to the same strength of gas. The indications are, however, that spring fumigation is more effective than fall fumigation. It may be said that other fumigants such as carbon tetrachloride, even at prolonged exposures, failed to give satisfactory results.

Dipping the stock in various solutions was also attempted. In some cases we secured perfect results with certain of these mixtures, but in others under exactly the same conditions, a few individuals came through unharmed. As was the case with fumigation, the spring treatments were more effective than the autumn treatments, but the only material that gave perfect results spring and fall was 5% (by volume) emulsion of carbolineum. The liability of this compound to injure the buds, however, makes it doubtful whether it will ever find favor for this purpose, unless some one can devise a stable product of constant composition, and of equal value as an insecticide, which will, at the same time, be harmless to the trees. Furthermore, dipping as a means of treating imported stock has many disadvantages, as compared with gas treatments. Not only is it very laborious, unpleasant, and not adapted to large shipments, but it leaves too much to the individual carefulness of the operator. Even should some treatment be found that proved effective in careful hands, it is a question whether this method would be adopted by any government as a means of treating imported stock.

ORCHARD TREATMENTS. The control of the insect under orchard conditions may again be subdivided into (1) treatments directed against the egg or hatching young, (2) treatments directed against the nymph and (3) treatments directed against the adult.

1. For dormant spraying we have obtained best results, so far, by spraying with the lime and salt wash recommended by Theobald (Insect-Pests of Fruit, p. 162, 1909), consisting of 100 lbs. lime and 30

lbs. salt to each 100 gals. of water. This gave the best results when applied as late as possible before the eggs hatched. It is believed that the wash acts mainly as a mechanical barrier to the emergence of the young from the egg, but the salt probably exerts some direct effect also, since the omission of this ingredient lessens the effectiveness of the wash. In our experiments we usually made the application as soon as the buds showed the first sign of green at the tips. Later than this the leaf tips are likely to be more or less injured from the action of the salt.

It is only by the use of the greatest care and thoroughness in covering every smallest twig with the wash that successful results are secured and, in practice, we have found it necessary to make two applications to produce the desired effect. The fact that it is almost impossible to get on clay land so early in the spring with a heavy outfit is another disadvantage connected with this method. It is only one that a careful worker, situated on favorable land, can successfully employ.

2. This insect is one of the most susceptible to sprays in the nymphal stage of any we have had experience with, provided the sprays are applied when the insect can be reached by them. It is useless to attempt control while the leaves are unfolding or while the flower stalks are still fastened together. To do so invites failure, for the insects cannot be reached by the liquid or dust. When the flower stalks have separated out, a careful spraying of nicotine sulphate, ¾ of a pint to 100 gals. is most satisfactory. We have not as yet experimented with a reduced strength of this compound, but believe that, provided a proper pressure, etc. is maintained, a weaker strength would be equally effective.

We were also able to secure very satisfactory results from the use of nicotine dusts. To state the matter briefly, a dust containing 2% or more of nicotine sulphate (40% nicotine) with sulphur as a base gave only slightly poorer results than nicotine sulphate used as a liquid. The addition of lime to this mixture increases its effectiveness, but such mixtures gradually lose their strength and must be kept in air-tight containers. Clay used as a filler in place of sulphur gives a very inferior product, from an insecticidal standpoint.

3. The long preoviposition period of this insect seems to offer, indeed to invite, attempts at control in this stage. We were surprised to find, upon making the attempt, that the different sprays and dusts employed against the nymphs could be used with equally telling effect against the adult.

In addition to spraying and dusting we also made several trials of open air fumigation, after the manner reported to have given good results in Russia.

Our experiments indicate that 360 lbs. to the acre of waste tobacco, free from incombustible material, will give good control under favorable

conditions. It is unnecessary to use hay as a starter for the fires, as they burn quite well without such assistance. We have used damp vegetation to prevent the material from blazing up, but it seems likely that watering with a sprinkling can would have the same effect and would shorten the work. The fires can be ignited most rapidly by the use of a torch.

Numerous small fires are better than a few large ones. Where the latter are used on a still day, the smoke has a tendency to ascend directly upwards and be lost. It is of advantage also to have a number of heaps held unlighted in reserve, so that in the event of a wind suddenly arising or changing its original direction, these reserve heaps may be transferred to the windward side of the orchard.

The fall of rain during the process is not particularly to be feared, since our experiments show that once started, the fires keep on burning, even through a heavy shower. It is not advisable, however, to leave heaps out long unlighted in the rain, as this will result in the extraction of a large part of the nicotine. The fires will have to be drawn together several times, as there is a tendency for a part of the outside of the heap to remain unconsumed. In fact, it is advisable to pick up the smaller fires by means of a fork and to add them to those burning more vigorously.

It must be borne in mind, however, that success could only be hoped for in isolated orchards, or in cases where the operations covered a very large area. Furthermore, to further lessen the amount of reinfestation, it would be advisable to defer treatment as late as possible before oviposition, viz., at the end of August. All our experiments, though successful in controlling the insect at the time were quickly reinfested from without. Only by cooperative efforts over a very large territory could one even look for good results from this method.

MR. W. E. BRITTON. I would like to ask if dusting with nicotine was tried?

MR. W. H. BRITTAIN. It was, and we found that if done at the right time, it was very effective. That is not mentioning the cost at all. It is a very easy insect to kill, either by dusting or spraying and either in the adult or nymphal stages may be used.

PRESIDENT GEORGE A. DEAN. The next paper is "Spray Schedule for Red Bugs in Pennsylvania," by S. W. Frost.

THE FALSE APPLE RED-BUG (*LYGIDEA MENDAX*) IN PENNSYLVANIA

By S. W. FROST, *State College, Pa.*

The apple red-bugs are destructive insects in all apple sections of Pennsylvania. In spite of thorough spraying many orchardists have reported a failure to reduce appreciably the amount of injury by these pests. In view of this situation a study of the seasonal activities of the red-bugs was made with the result that the eggs were found to hatch somewhat earlier in most years than was generally supposed. Our records for a five year period confirm the earlier observations and it is now obvious that the pink spray comes too early to control the false red-bug.

The apple red-bugs were first noted as pests in Pennsylvania in 1912 when they were numerous enough to attract attention by the orchardists. Since that time they have increased rapidly in numbers and damage due to their work has been reported from all sections of Pennsylvania where apples are grown. During 1918 the damage in some orchards of Pennsylvania was as much as 80 percent. In 1919 there were few orchards in which susceptible varieties of apples were grown that did not suffer a greater or less amount of injury. The season of 1920, however, was notable for an overwhelming outbreak of the pests in Pennsylvania. During 1921, likewise, the amount of injury ran high in some orchards.

Since the publication of Professor C. R. Crosby's bulletin on the Red-bug, there has been no extensive work published on these insects to guide the fruit growers in their attempts to control the pest. The discovery in recent years in Pennsylvania, as well as other Eastern states, of certain facts regarding the life history and activities of these insects lend valuable suggestions for better control practices and noticeably hange the original recommendations.

SPECIES CAUSING INJURY TO APPLE

As in other Eastern states, two species of Red-bugs have been found in Pennsylvania attacking the apple; the true red-bug, *Heterocordylus malinus* Reut., and the false red-bug, *Lygidea mendax* Reut. The former species is not abundant in Pennsylvania and is not as injurious as the false red-bug. *Heterocordylus malinus* Reut., therefore cannot be considered at present as an injurious pest of apple in our state. Until the true red-bug is found more abundant, the timing of the spray applications should be made according to the habits of the false red-bug, *Lygidea mandax* Reut.

Seasonal Activities of the False Red-bug

The nymphs hatch shortly after the time that the color is showing in the cluster buds. From records taken during the years 1917 to 1921, it appears that in Pennsylvania the hatching of the red-bug eggs occurs after the pink condition of the buds. No nymphs were observed during these years before the blossom pink. During the unusually early spring of 1921, the relation of the hatching of the nymphs and the development of the buds remained the same and the eggs did not hatch until a considerable time after the pink condition of the flower buds.

The investigations of five consecutive years have been summarized on the following chart. During this period there were four normal years. In 1921 conditions as regards the bud development were extremely early. The data secured during this abnormal year add con-

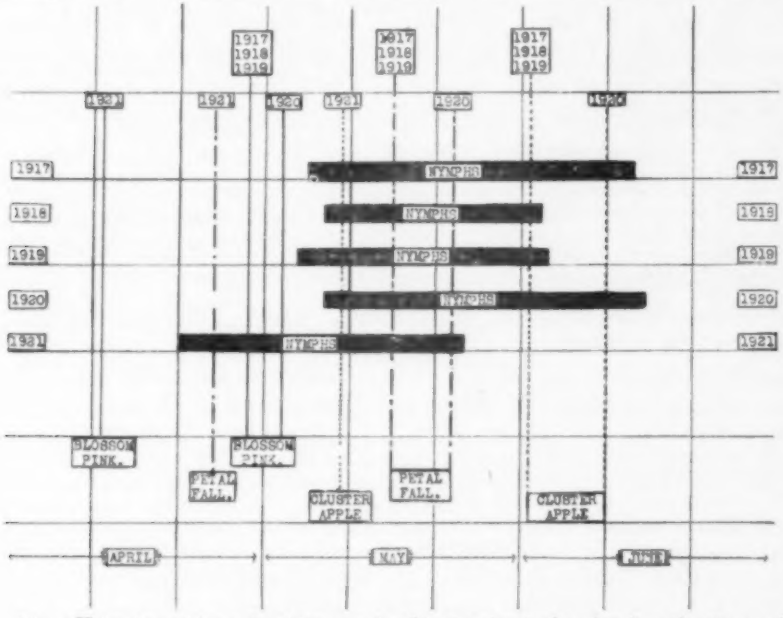


Fig. 2—Apple red-bug, *Lygidea mendax* Reut.; chart showing length of nymphal stage during five successive years.

siderably to the value of the chart as it shows very clearly that the same relation of bud development and insect activities exists even under extreme conditions. The horizontal broad, black lines indicate the length of the nymphal stage of the false red-bugs from the hatching of the first nymphs to the transformation of the first adults. The activities of the nymphs would therefore extend over a longer period than indicated by a single line for any particular year. The nymphal periods are based entirely on field conditions in a number of orchards. No

rearing work was done, but a careful search was made each spring for the earliest appearance of the nymphs. A large number of them were collected from time to time throughout the spring and summer and brought into the laboratory for the determination of the species and the several instars. The vertical lines for the blossom pink, petal fall and cluster apple applications were secured from actual spraying dates from six to ten orchards during these years. During 1917, 1918 and 1919 the dates for the applications were practically the same and represent normal years. In 1920 the various sprays were applied somewhat later than during the preceding years while in 1921 the season was much advanced and the sprays were applied from three to four weeks earlier than usual.

The data on the chart has further been corroborated by spraying experiments conducted in various orchards throughout the state. During the spring of 1920 a number of tests were made in various apple growing counties to ascertain if spraying in the petal fall and the cluster apple periods would reduce the damages from red bugs. These sprayings gave uniformly good control and the resulting injuries were small.

Timing of Operations

Two sprays are necessary to secure the most satisfactory control of red-bugs. The apple growers should watch for the first indications of foliage spotting by the nymphs and when this becomes noticeable preparations should be made to combat the pest in the following two sprays. In ordinary seasons these will be the Petal fall spray, when two thirds the petals have fallen and the Cluster apple spray which is two weeks later or when the young apples are the size of hazelnuts.

Adjournment.

Common Names of Insects:—The Committee on Nomenclature of this Association has prepared a list of about 1,000 insects, giving both common and scientific names. More than 300 common names have already been adopted by this Association, and the other 700 are now under consideration by the Committee. This list or a portion of it will be submitted to certain entomologists experienced in editorial work, former members of the Committee and specialists in the different orders. The whole list or any part of it will also be sent to any member on request who will carefully examine it and make suggestions looking toward a greater stability in common names of insects. The Chairman of the Committee on Nomenclature is Doctor Edith M. Patch, Agricultural Experiment Station, Orono, Maine.

REPORT OF MEETING OF COTTON STATES ENTOMOLOGISTS

Dallas, Texas, Nov. 30—Dec. 2, 1921

The meeting was called for the purpose of discussing the present status of the Camphor Scale, Mexican Bean Beetle, Pink Bollworm, Sweet Potato Weevil and Argentine Ant. The following representatives were in attendance at the various meetings: Drs. W. D. Hunter, C. L. Marlatt, Karl F. Kellerman and Geo. B. Sudworth of the Federal Horticultural Board, Messrs, E. R. Barber, F. C. Bishopp, J. E. Graf, W. E. Laake, Oscar Pool, K. H. Townsend and R. W. Wells of the Bureau of Entomology, Dr. W. E. Hinds, State Entomologist, Ala., Dwight Isely, Ark. Experiment Station, Geo. G. Becker, Ark. Plant Board, W. E. Anderson, La. Department of Agriculture, T. H. Jones, La. Experiment Station, H. H. Kimball, Miss. Plant Board, C. E. Sanborn, State Entomologist, Okla., G. M. Bentley, State Entomologist, Tenn., R. E. MacDonald, E. E. Scholl, J. M. Del Curto, J. M. Worsham, and J. S. Woodard of Texas Department of Agriculture, Dr. M. C. Tanquary, S. W. Bilsing and J. S. Reinhart of Texas A. & M., W. B. Lanham and R. R. Reppert Division of Extension, Texas A. & M., Hon. Harry Wilson, La. Commissioner of Agriculture, Hon. W. Perkins, La. Pink Bollworm Com., Hon. Geo B. Terrell, Commissioner of Agriculture of Texas.

Methods for Studying Insects Affecting Live Stock

The party spent a very interesting morning in the Dallas laboratory of the U. S. Bureau of Entomology, where Mr. Bishopp and his associates explained the various projects under investigation. There were general discussions on laboratory and office record systems, on photographic methods, and on systems for filing and recording alcoholic material in which the Bureau methods were thoroughly discussed and demonstrated. Various fly traps were studied and their merits and demerits pointed out. Mr. Bishopp gave us an interesting talk on the use of traps under range conditions and also explained the reaction of various species of flies toward various baits. Dried egg, according to Mr. Bishopp, is the best all-around bait for a number of species of flies which are of economic importance to the stockman. It is suggested that the southern entomologist may get some information of great value to them if they will write to Mr. Bishopp for information on the use of this bait.

The formal session of the Cotton States Entomologists was opened at 3 P.M. at the Jefferson Hotel. Dr Hinds presided. The first paper on the program was on the Camphor Scale, by Mr. E. R. Barber of the Bureau.

The Camphor Scale Situation

Mr. Barber pointed out that we knew practically nothing about the camphor scale. The pest is known to occur in Japan on citrus stock but it seems to be of little economic importance there. Outside of Japan the pest is not known to occur at any place other than New Orleans. This insect is supposed to have been introduced by N. Cook & Son, rose specialists of New Orleans, in a large shipment of roses from Alhambra, California.

The rapid spread of the pest has been very striking. It was discovered August 4, 1920 by Mr. Barber on some camphor trees in front of his home, not far from the Cook nursery; the scale was found on every species of plant around the place. The following spring the scale had spread to 27 blocks, with the original infestation as a center. Later there was a severe storm and it was found that scales were blown to a point two miles away from the original infestation.

In June 1921 the city of New Orleans appropriated $5,000 for eradication. This was later increased through various means to $15,000 and later the state made an appropriation for eradication. The first step consisted in making a survey to ascertain the amount of infested territory, which was about four square miles. There were about seven or eight nurseries in this territory and to these nurseries 148 isolated infestations in the rest of the city were definitely traced. A later survey turned up 200 more infestations. All told 450 isolated infestations were found outside of the original infested area and these were cleaned up. The isolated infestations discovered in the first survey were traced without exception to nurseries in the infested area. All of the balance occurred along paved and much traveled streets which passed through the infested area. It appeared that the latter infestations were spread maliciously.

A long series of experiments were carried on to determine a satisfactory spray.

Lime sulphur, miscible oils and numerous other preparations were tried without success. Finally a 2% emulsion consisting of fish oil potash soap and Junior Red Engine Oil (a Standard Oil Product) was found to give 100% control. All of the trees in the infested area were defoliated by pruning out all branches and limbs which had leaves on them and the trees were then throroughly sprayed. As an indication of the efficiency of the treatment, in 89 examinations out of 100, made 30 days after spraying no live scales were found. Three of the four square miles to be treated have been covered. It is planned to spray twice a year.

Mr. Barber now has two men who are turning out 1000 gallons of concentrated emulsion a day. The following formula is used: Potash fish oil soap, two pounds; Junior Red Engine Oil, two gallons; water, one gallon. The soap water is brought to boil with live steam, oil is added and the mixture boiled for five minutes. It has to be pumped twice before a satisfactory emulsion can be obtained. The concentrate costs 25c a gallon, which makes it cost 1c a gallon of solution ready to spray.

In marked contrast to the resistance of this scale to various spray materials is its susceptibility to cyanide gas. The gas from one ounce of NaCN to 1000 cubic feet kills all scales. The fumigating was done at a temperature of 85—92 degrees Fahrenheit. It was found that plants with flowers and leaves on could be exposed to this dosage for one hour without being damaged provided that they were put in the shade after the treatment.

Very little is known concerning the biology of the pest. The scales settle within a few hours after they are hatched. The males are always on the leaves and the females on the twigs. The females deposit from 200—250 eggs over a period of about one month. The unusually large scale of the overwintering female as compared with the summer form is interesting. It is considerably larger than is necessary to cover the body of the insect. Ants have been noticed in considerable numbers around infested trees and are doubtless factors in the infestation. So far about 8 species of parasites and predators have been found to prey on the species but it is doubtful if they cause 2% mortality. The insect is not known to be a carrier of disease.

The extremely toxic effect of this scale on most of our plants is of greatest importance. Only a few scales on a twig will cause defoliation. Trees have been known to be killed six months after they were attacked. Camphor, fig, rose, hackberry, elm, citrus and many other hosts are extremely susceptible to attack. The list of known hosts covers 172 species of plants. It seems certain that its noxiousness is by no means confined to tropical and semi-tropical plants and it must certainly be regarded as a potential pest of the first magnitude, for latitudes north of New Orleans until it can be definitely established that the climatic conditions there are such that the scale cannot thrive.

The quarantine work in connection with this insect was discussed by Mr. Barber and Mr. Anderson. The quarantine includes all territory within a radius of 20 miles around New Orleans and has been effective since June 1921. No certificates are granted to any nursery located in this territory. All nursery stock from this territory must be inspected by a state inspector and must be fumigated by him. No nursery stock whatsoever is allowed to move out of the infested territory and nurseries located in this area are now out of business. Every nursery in the quarantine area is inspected once every thirty days. There is thus a quadruple protection in the fact (1) that all nurseries in the infested area are out of business. (2) No blanket certificates are granted to any nurseryman within a radius of 20 miles of the infestation, (3) all stock in the quarantine area and not in the infested area is first inspected by a state inspector and is then (4) fumigated by this inspector. All post office clerks and agents of common carriers are well informed on the regulations.

Mr. Anderson stated that they were now at work tracing shipments of plant products which went out of the infested area before the infestation had been discovered but that the work was progressing slowly on account of the lack of funds. He suggested that other states might be able to render help in some sort of a cooperative capacity for hastening this work. Three infestations in Mississippi have been traced to New Orleans but they have been stamped out.

It was generally agreed that "Camphor Scale" was not a very appropriate name for this pest in that the insect attacked a large number of hosts among them being all species of fruit trees, as well as oak, hickory, hackberry, elm and numerous other hosts. Those having a more appropriate name to suggest should communicate with the committee on Nomenclature of the American Association of Economic Entomologists.

The Mexican Bean Beetle (*Night Session*)

At this session Dr. Hinds gave an illustrated talk with a most unusual set of slides showing the Mexican bean beetle in all of its stages and Mr. Graf discussed the spread of the pest, work with insecticides, and the result of effort to find natural enemies.

Many of the illustrations appear in Dr. Hinds' bulletin on the Mexican Bean Beetle and in the same bulletin is a thorough discussion of the life-history and habits of this pest. In Alabama there were four generations of the insect in 1920. In 1921, although there was ample time for the development of a 5th generation, it did not appear. In 1921 Dr. Wickham left Alabama when the infestation was at its crest and when he arrived at the high elevations in Mexico to collect parasites he found that this pest had practically disappeared for the season. In New Mexico the insect has but two generations a year. It is thought that the cool nights might possibly cause a chemical change in the leaves which may cause breeding to stop.

The discussions of Dr. Hinds and Mr. Graf showed that the pest was evidently not at all settled to eastern conditions. In 1920 it migrated at the end of the season whereas in 1921 most of its migrating was done in early summer.

Dr. Hinds pointed out that an important fact in considering the possibility of spreading this pest in shipments of nursery stock is the fact that a female fertilized in the fall may winter successfully and deposit fertile eggs the following spring. New infestations may thus be established by transporting a single hibernating female to a new locality.

It now seems certain that the insect was introduced into Alabama in shipments of alfalfa hay from Utah. Dr. Ball states that before the war the bean growing area in Utah was isolated from the alfalfa growing regions but during the war it became profitable to grow beans in the alfalfa regions and for the first time the beetle had an opportunity to be carried out of the state in alfalfa hay. It was at this time that it was carried to Alabama.

In regard to host plants, mung beans and velvet beans seem to be rather resistant to this insect. Beggar weed seems to be a favorite host. Cowpeas seem not to be attacked ordinarily until they are 20—30 inches high, according to Mr. Graf.

Dr. Hinds has reared the insect through all its stages on alfalfa and velvet beans. It will feed on non-leguminous plants when it is starved to it. The insect is primarily a leaf feeder though it will feed on the pods when the leaves are gone. In order of their susceptibility to the Mexican bean beetle Dr. Hinds places the legumes as follows: (1) kidney beans, snap beans and corn-field beans, (2) lima beans, (3) cowpeas and (4) soy beans.

The destructiveness of the pest is well known to all southern entomologists who have followed the history of the pest. Dr. Hinds states that in 1919 a farmer near Birmingham made $400 on an acre of late beans. The following year he planted two acres the first week of August, had to plow them under the first week of September, and did not get enough beans to can for home use. This case is quite typical. The insect will cause a 75% loss to the bean and pea crop of the territory infested.

According to Mr. Graf control of the insect by the use of arsenicals is very difficult. The stable arsenates are not effective. They seem to pass through the digestive tract of the insect before they can be acted upon. On the other hand the insecticides which are effective against the insect are very injurious to the tender foliage of legumes. In hot dry weather effective insecticides can be used without injury but if the weather is humid, injury will result. The most stable forms of calcium and lead arsenate will strip the vines. If this pest is to be controlled by the use of insecticides, a new one will have to be used.

Control by the use of natural parasites is equally unpromising. After seven weeks in Mexico, Prof. Wickham found only one parasite, a Tachinid parasite which attacks the adult beetle. This was found quite by accident.

The present range of the insect in the South includes 36 counties in Georgia, 34 counties in Alabama, 34 counties in Tennessee, and 2 counties each in Kentucky, North Carolina and South Carolina.

Sweet Potato Weevil Eradication (*Morning Session, December 1*)

This subject was discussed by Mr. J. E. Graf. It was pointed out that the sluggishness of this insect made it an easy subject for eradication. The matter of eradication is not a technical one but is rather a problem of thorough extension work with a view to getting farmers of the infested area to co-operate. Where one can control the planting seed and slips which are used in the infested area and can combine this with clean culture, the problem of eradication has been solved.

The method used in Mississippi and Florida of supplying slips has given some trouble. The farmers in the infested area depend upon sweet potatoes for much of their food and when bedding time comes they are afraid to wait for slips which the plant board promises to send them later. For this reason many out-law slip beds are planted.

In one case nine reinfestations were traced to an out-law slip bed. Instead of supplying slips as in the past, the farmers will be supplied their sweet potatoes and will be allowed to bed them down for their own supply of slips.

The eradication work has involved, all told, about 900 farms. In Florida only 30 infested premises remain out of 300. In Alabama eradication is complete in practically all areas where potatoes are grown commercially. The largest amount of eradication work is still ahead. In Texas the weevil occurs more or less generally in all that territory east of a line drawn due north of San Antonio and extending to the Red River. It might be of interest to state here that Mr. Sanborn said that he had recently found the weevil at Antlers, Oklahoma and Mr. Jones stated that it had reappeared at Shreveport, Louisiana.

One of the difficulties of eradication work was to complete it after the weevil had become almost exterminated in an area. When weevils have been reduced to the extent that they no longer cause any damage farmers lose interest in the work. Thus it is practically necessary to visit infested farms at least once a week. The inspector virtually supervises the growing of seed potatoes for the entire season. Extension work should be more vigorously pushed in connection with eradication and farmers should be thoroughly impressed with the destructiveness of the pest.

There are two times of the year to scout for the weevil. One is in the fall at harvest time, the other in the spring when the potatoes are to be bedded. In the fall the pest is detected by tearing the vines apart; in the spring in the potatoes. During the time that potatoes are in curing, development of the weevil is doubtless accelerated. Wild morning glories are known to harbor the pest. In general any large rooted morning glory will make a good host. Of greater importance than the abundance of wild hosts is climate. But for this Mr. Graf thinks that the pest would be destructive in California.

In regard to the size of a safety zone around an infestation, five miles is considered ample. The biggest factor is preventing the weevil from being carried from one place to another in seed. The ordinary "visiting distance" is not more than about five miles for the average farmer. Inspection of potatoes for the weevil at harvest time is considered worthless.

Eradication of the Argentine Ant

Mr. Barber discussed the life-history and habits, economic importance, methods of control, including the making of the poisoned bait and application of same. The control of this pest is fraught with many technicalities. Eradication work should be carried on under the immediate supervision of an entomologist and the entomologist will do well to get instructions from Mr. Barber.

The economic significance of the Argentine Ant is so overwhelming and the control measures have been so thoroughly worked out that entomologists should find eradication work to be an unusually profitable project. Fortunately it can be accomplished at a small cost and the funds can, in most instances, be raised locally. A few carefully conducted eradication problems will do much to popularize entomological work.

The Argentine Ant causes at present an annual loss of not less than $25,000,000. It has been conservatively estimated that this is only about 1% of what it is capable of doing. In orange groves and sugar plantations its injury comes indirectly. Its presence in orange groves is noticed by a large increase in infestations of all kinds of scale insects which under normal conditions are not an economic factor. In sugar plantations mealy bugs become unusually injurious. In cities shade trees are killed by scale insects which are hardly noticed before the appearance of the ants. In the citrus growing area which is infested by the ant, groves have been planted over and over again only to be killed out by scale insects which become abundant because their natural enemies are being kept away by the ants. In addition to these losses there are heavy losses to food products in storage. It is almost impossible to raise chickens or keep bees in infested areas.

Eradication is now being carried out in New Orleans and Baton Rouge on a large scale. About 150 cans of poison are being used to a city block. The complete cost for one treatment is about $12.00 a block. Funds for this amount can usually be secured without any difficulty. Eradication can be done in the fall or in the spring but the best time is from about August 15 to October 15. After the first year the

work should be followed up for two or three years following, using about ¼ the number of cans used in the first campaign. Complete eradication is considered entirely possible. The best can used for the syrup is the stock shrimp can holding about 6 ozs. They are bought with special lids.

In scouting for the Argentine ant first look around in the wholesale districts where freight is being loaded and unloaded. Then look at trees. Trees in infested areas can usually be seen 16 to 18 feet away by one who has a trained eye. They are usually badly infested with scale insects and the characteristic movements of the ants can be observed. Mr. Bishopp says that the Argentine ant has a characteristic odor and this was confirmed by Mr. Kimball. When the edge of the infested area has been found it is an easy matter to trace out the area.

Fully one-half of successful eradication depends upon the preparation of the syrup. An ordinary druggist cannot be depended upon and even a chemist is likely to be careless. Syrup is being made for New Orleans, Baton Rouge and other southern cities under Mr. Barber's supervision and can probably be purchased for about 65c a gallon. A number of firms have been making ant syrup, charging as high as $3.00 a gallon for it, but their products are not dependable.

Campaigns have often been discourged by local druggists and others who have been making money in the sale of proprietary compounds and they have disseminated propaganda stating that children have been poisoned by the syrup. In conducting eradication campaigns this sort of propaganda should be headed off and the methods of eradication discussed carefully in advance.

COTTON SEED STERILIZATION (*Afternoon Session*)

Cotton seed sterilization, according to Mr. R. E. MacDonald, should be put into practice by every southern state as an added precaution against the spread of the pink bollworm. It is believed that sterilization can be developed to the point where practically 100% of the worms can be killed; 98% of the worms are being killed with seed temperature at 130° F.

Mr. MacDonald's figures were based on investigations which he had conducted and on investigations which were conducted by the Bureau. It was found that seed could be heated to a temperature of 170°F. and held at that temperature for an hour without hurting the seed. Moreover the heat treatment apparently improved the germinating quality of the seed. Egyptian workers consider that 162° F. is a safe temperature for seed.

It was found that the thermal death point of Pectinophora larvae was between 130 and 145° F.

130°	F.	for	45	min.	killed	100%
130°	F.	for	30	min.	killed	62.5%
135°	F.	for	35	min.	killed	100%
140°	F.	for	20	min.	killed	100%
145°	F.	for	10	min.	killed	100%

The above temperatures are the temperatures which the seed mass actually reached. To attain these temperatures it was of course necessary to have the oven much hotter as heat penetrates the seed mass very slowly. This was thoroughly demonstrated by MacDonald in a number of experiments. It was found that with the temperature of the oven at 239°F. it took five minutes to raise the temperature of the seed mass, two inches deep, from 73° F. to 82° F. With the oven at 275° F. it requred 45 minutes to raise the temperature of the seed mass at four inches deep from 73° F. to 140° F.

To heat effectively a machine must be devised which will keep the seed stirred up so that the seeds will be isolated one from the other and which will heat the seed to the required temperature in not more than about five minutes. A sterilization apparatus requiring longer than this would not be practicable. The sterilizer must be carried as a continuous process of ginning. In the sterilizers which it is planned to put in effect in Texas the seed will be heated to much higher temperatures than is done in Egypt. The seed mass when it leaves the machine should be about 140° F. In addition to the high oven temperature the seed will be subject to a continuous and somewhat protracted high temperature on account of massing and retaining the heat after it leaves the oven because of the numerous air spaces between the fibers.

Several types of machines have been devised in Texas. One type consists of a series of belts upon which the seeds are spread out one layer thick and carried through the oven several times. Belt number one carries the seeds the full length of the oven and drops them on belt number two and so on. Another type consists of a sheet iron revolving drum about three feet in diameter and ten or more feet long, the flanges on the inner circumference, which carry the seed to the top and drop them down continually over a number of radiating steam pipes which revolve with the drum. A third type is now in process of manufacture by the Ryland Company of Austin. It consists of a series of cut flight conveyors operating inside an insulated steam oven. The upper conveyor carries the seeds the full length of the oven and delivers them to the next conveyor which in turn carries them to the next conveyor and so on.

The different types of machines will be taken to Mexico, tried thoroughly and if successful, attempts will be made to ultimately require all cotton gins to be equipped with sterilizers.

Pink Bollworm Scouting

Mr. K. H. Townsend gave a report on the progress of pink bollworm scouting conducted by the Federal Horticultural Board under his supervision. His work is summarized in a report which may be had on application to the Houston office. In the same report is a record of the tracings of all Carlsbad seed. Another report, "Summary of the Pink bollworm Situation" released by the Federal Board of Horticulture under date of November 26 should also be in the hands of all southern entomologists.

Scouting work is begun each year at the southern end of the cotton belt and the scouts moved northward as the season advances. Whenever an infestation is found, tracing is done at once by the central office and new scouting points are included in the itinerary. Scouting is begun at Brownsville about June 15.

On October 6 scouting was begun at Ennis and after only about two weeks an infestation was found about three miles south of Ennis. Carlsbad seed has been planted south of Ennis as far as Kaufman County. During the three weeks following the infestation four more infested fields were found. Scouting was carried out in all directions from the infested centers but no more pink bollworm was found.

A few weeks later an infestation was found at Marilee. The infestation occurred on the Collins-Grayson county line and occurred in two fields. It arose from flights of moths which emerged from Carlsbad seed which had been stored in a gin house, as no infested seed has been planted.

About two-thirds of the places getting suspicious Carsbad seed have been scouted to date. Fifty scouts are now in the field. All ginning territory around Marilee is considered dangerous for another year. At Ennis the scouts put in at the rate of one man a day per ⅗ acre.

In the Carlsbad area (including four towns) infestations were found at each place. The infestation is regarded as being generally distributed over about 15,000 acres.

It is expected that scouting will be completed at all suspicious points which need it. There is still scouting to be done in Texas, Oklahoma and Louisiana.

Mr. MacDonald then discussed some observations made on his Mexican trip. Damage from the pink bollworm ran all the way from 5% to 75%. In some places the boll weevil and the pink bollworm caused a total loss. In one field at Torreon 90% damage was noted.

General Discussion on Cotton Dusting

Mr. MacDonald made the statement that where cotton had been dusted for the boll weevil he found the bollworm (*Chloridea obsoleta*) to be much more severe than where dusting had not been carried out. Plant lice were also much more severe. He attributed the presence of large numbers of plant lice to the fact that predators had been poisoned.

Mr. Bishopp verified these findings. He attributed the increase in bollworms to the fact that predators which ate the eggs of this species had been killed. Mr. Reinhart also verified the statement made with reference to the abundance of plant lice, and stated that it was at a time when it was hot and dry and when heavy plant lice infestations were not to be expected. It was noted that hymenopterous parasites were still at work, however, though there was a marked decrease in the number of Coccinellids.

Mr. Reinhart's experience led him to the conclusion that it did not pay to dust this year. In one case his dusted plots yielded no more than the check and in another instance there was a 30% increase as a result of dusting. He had to put on 8 or 9 applications to put down the infestation.

Dr. Hinds thinks it pays to dust early in the fruiting season and when the weather is rainy. In hot dry weather it will not pay. Four or five applications under the proper conditions will be profitable. As far as failure of dusting to control bollworms is concerned Mr. Bishopp thinks that applications have not been made on time. This should be done within two or three days after hatching of the bollworms begin. After that time the worms can not be reached. Theoretically this period is about the time when the field corn begins to harden.

Moving Pictures on Insects Affecting Live Stock (*Night Session.*)

Mr. Bishopp gave us four interesting and highly entertaining reels illustrating Stable Flies, Horn Flies, Screw Worms and Ox Warbles.

Each reel showed characteristic habits and poses of the species of flies, which were illustrated, the mouth parts, stages of the insects, how they affected stock and methods of control of each species. Model traps were shown and methods of operation for each species were illustrated. Proper stacking of straw to prevent breeding of stable flies was shown. The treatment of screw worm infested sores and the destruction of carcasses was illustrated in connection with this pest. By far the most interesting reel was the one illustrating the Ox Warble. Every southern entomologist who has occasion to do extension or teaching work should make an effort to borrow this reel from the Bureau. The subject is handled in a very entertaining and most popular as well as a very forceful way. Incidentally ox warble eradication offers a most fruitful field for the entomologist's consideration.

Extension Entomology (*Morning Session, Dec. 2*)

An informal discussion was carried on for about an hour before the pink bollworm hearing, during which extension entomology was discussed. The feature of the discussion was a plan submitted by Mr. Anderson in which he proposed to divide the state of Louisiana into eight or nine districts. In each district there was to be a competent entomologist who was to conduct not only inspection and quarantine work but also extension work. He was to inspect all nursery stock and other plant products of his district and was to be in complete charge of all regulatory work. In addition to this he was to give expert advice and help to the county agents in his district. This work was to be divided into four seasons. In the winter the work would consist largely of inspecting nursery stock and of making plans for spring and summer. In the spring and summer demonstration spraying would take up much time as well as regulatory work along this line During this same period there would be sweet potato weevil eradication and in due time Argentine ant eradication.

It was generally agreed by all those present that there was a very fertile field along the lines suggested by Mr. Anderson.

Mr. Reppert was of the opinion that an extension entomologist could not afford to jeopardize his work with the regulatory work as in all regulatory work much hostility is engendered. It is also doubtful if men working under Government funds could be allowed to do regulatory work. Under the conditions which obtain in Louisiana, however, the plan is workable.

The balance of the day was spent in connection with the pink bollworm hearing. Most entomologists have by this time received the resolutions passed at that hearing and it is thought that these resolutions will form the basis for the future policy of the Federal Board of Horticulture in the eradication work.

George G. Becker, *Secretary*

RESOLUTIONS

Passed by the Cotton States Entomologists in session at Dallas, Texas, November 30 to December 2, 1921.

Whereas, the cost of eradicating the pink bollworm is insignificant in comparison with the economic consequences to the whole United States as a result of the permanent establishment of the pink bollworm in the South, and

Whereas, the eradication work of the Federal Horticultural Board cooperating with the States of Louisiana and Texas through the maintenance of non-cotton and regulated zones has, in our judgement, showed that this pest can be eradicated, and

WHEREAS, there is necessity for further immediate investigation of the possible occurrence of the pink bollworm at several suspected points in the cotton belt, and

WHEREAS, it is our belief that sterilization of cotton seed, regardless of where grown, would be an important protection in preventing the spread of the pink bollworm;

Be it therefore resolved, that we urge upon Congress and upon the legislature of the different southern states the appropriation of ample funds to assure prompt investigation of all suspicious reports of the presence of the pink bollworm and of providing, without delay, for the immediate creation of non-cotton and regulated cotton zones where necessary.

Be it further resolved that the eradication of the pink bollworm through the maintenance of non-cotton and regulated zones be not only continued as at present but extended without delay wherever the result of scouting work shows this to be necessary.

Be it further resolved that thorough pink bollworm scouting covering all possible points of infestation should be completed in time this year to include additional areas in the non-cotton and regulated zones next season for all additional areas where the pink bollworm is found.

Be it further resolved that we urge the adoption of compulsory cotton seed sterilization to the end of reducing the danger of the possible spread of this pest.

M. C. TANQUARY
GEO. G. BECKER
H. H. KIMBALL
Committee on Resolutions

Scientific Notes

Notes on Stictocephala festina. In the detailed account given of this pest as published in the *Journal of Agricultural Research* Vol. iii, No. 4, it is pointed out that the insects had not been found above 3868 feet. During the summer just past the insects were found quite abundant near Prescott, Arizona, at elevations of 5400 feet.

In the account above cited injured alfalfa plants are spoken of as yellowish in appearance. In the Verde Valley and vicinity, Arizona, affected plants generally have a bluish or purplish color. In the late summer or early fall fields are common with scarcely a shoot free from this discoloration. I have found a rather large percent of the girdles or cankers infected by a species of *Colletotrichum*, apparently near *destructivum* O'Gara.

WYATT W. JONES
Salt Lake City, Utah

Successful Poisoning of Eleodes Beetles—False wireworms, larvae of *Eleodes hispilabris*[1], are a serious pest of dry land grain in Idaho, and are increasing in numbers at an alarming rate. Because no effective, practical control measures have been known, it has been impossible to give needed help to farmers. The possibility of poisoning the adults before they have mated and deposited eggs has appealed to the writer since he first began studying the problem. In August 1921 field observations were made as to the habits and food of newly emerged adults. Laboratory experiments were then conducted to determine whether beetles could be killed successfully by poison preparations. Following this, poisoning was undertaken on a small scale under field conditions and finally the operation was broadened to cover a forty acre field. Field observations lead to the belief that adults emerging in late July and early August do not mate and lay eggs until the following spring.

Essential data are: Adults feed greedily for at least a month after emergence, during which time no eggs are deposited. They are readily killed by poison bran

[1]Det. Joe S. Wade—United States Bureau of Entomology.

mash before they have had an opportunity to reproduce. They are active travelers and when coming to a depression or furrow are likely to follow along the bottom for a distance before climbing out. They eat poison bait readily even when there is an abundance of unpoisoned food.

Eleven days after bait was applied lightly in a furrow 390 yards in length, 7653 dead beetles were counted. A large number, in addition, had crawled away from the furrow before dying. Poison bait was apparently as effective at the end of 10 days as when first distributed. Thousands of beetles were killed by broadcasting poison mash on waste land and around straw stacks. The cost of material for treating 40 acres by the furrow method was 70 cents, less than 2 cents per acre—furrows spaced 100 yards apart. By a mechanical device, a furrow was treated as fast as a team could walk. It appears possible to very nearly eradicate *E. hispilabris* in a community by use of poison bran during two successive seasons, if cooperative work is done over a large area. During the present year, the University of Idaho will carry on further work on life history and large scale control of species of Eleodes injurious to grain.

CLAUDE WAKELAND
Entomologist, University of Idaho Extension Division

Some Ants noted to infest houses in Mississippi during the summer and fall of 1921. During the summer and fall of 1921, the writer had the opportunity of observing many species of house ants in Mississippi. This opportunity arose during the period when the writer was scouting for Argentine ants or assisting in the campaign against these ants in many of the towns in the State. It seems well to mention very briefly here the species observed and what has been noted concerning their distribution and habits.

Ten species have been noted as house pests. Six of these are imported ants, the others are native ants. In mentioning these ants below, the writer will rank them according to his idea of their economic importance as house pests in Mississippi.

By far the worst house ant in the State is the Argentine ant, *Iridomyrmex humilis* Mayr., which has been recorded from forty-one towns in this State and no doubt occurs in many others, of which we have no record. As a house pest this ant has the habit of crawling everywhere; getting into peoples' beds, driving setting hens from the nest, crawling over ice cold meat in refrigerators and acting as distributors of injurious scale insects on shade trees and fruit trees.

The next two species, one of which is an imported ant, hold about equal rank as house pests. *M. pharaonis* L. and *Monomorium minimum* Buckley, are practically the same size and have similar habits, being particularly fond of meats and greases. The former is known as the small red ant or Pharaoh's ant, and the latter as the tiny black ant. Both species are widely distributed throughout the United States and the writer believes they are widely distributed in Mississippi, as he has found them in practically every town visited.

Solenopsis geminata Fabr., commonly known as the fire ant because of its stinging habit, seems to be a common house pest also. Like the two species above, it prefers meaty foods, but will eat sweets when the opportunity permits. The writer has not observed any of these ants nesting in houses and he doubts very much if they do so, since they are soil nesting species. Their crater-like nests in the soil are generally found in sunny spots. No doubt they stray into houses because of the scarcity of food outside.

Another species of this genus—the tiny yellow thief ant, *Solenopsis molesta* Say, is a house pest also. It resembles *M. pharaonis* superficially, but it is much smaller

than that species and can easily be distinguished from *M. pharaonis* when examined under a microscope. It not only occurs in houses, but has been noted to attack the seed of cereals in Kansas.

The acrobatic ant *Cremastogaster lineolata* Say, has been found to occur in a number of houses. This ant is widely distributed over the State and has a fondness for sweets. This is no doubt the reason why it is attracted to houses. Out doors it may nest under stones, in wood, in galls, etc. Because of these varied nesting habits it is possible that *lineolata* may nest in houses, but it is the writer's opinion that this is seldom, if ever, the case.

Iridomyrmex analis Mayr, an ant closely related to the Argentine ant in general character and habits and often mistaken for this species, has been found to give trouble in houses. This seems to be exceptional rather than the rule. These ants are also fond of sweets like their near relative the Argentine ant. The two species can be readily distinguished from each other by the presence of a sweetish sickening odor given off by the workers of *analis* when crushed, while the workers of *humilis* have no perceptible odor. *I. analis* also has a much lighter colored abdomen than the Argentine ant, workers of the latter being of a uniform brownish coloration.

Tetramorium guineense Fabr. has been noticed to occur in one of the sea port towns of this State—Pascagoula. It is an imported species, having come from the Old World. In some towns in the United States it has assumed importance as a house infesting species. So far as the writer knows it has caused no trouble in Mississippi.

Another imported species, *Solenopsis geminata* Fabr. subsp. *rufa* Jerdon, has been recorded from Tupelo. This ant, which is also an Old World species is capable of becoming a house pest, although it has not been reported so from that town to date. A striking fact is that no other species seems to be present in the town where this ant occurs. It is quite possible that *S. geminata rufa* has driven out the native ants.

Camponotus caryae var. *rasilis*, a very striking red and black species that nests in trees, has been observed to infest one house this year. The workers showed a particular fondness for sweets, infesting jam, sugar and syrup.

M. R. SMITH
Mississippi State Plant Board

Sulphur Investigations. It is most gratifying to state that the Crop Protection Institute has succeeded in securing the cooperation of three sulphur companies—The Union Sulphur Company, The Freeport Sulphur Company and The Texas Gulf Sulphur Company—in providing for basic studies of both the entomological and phytopathological aspects of sulphur, each in relation to meteorological conditions. These companies have agreed to provide $7500 a year in addition to raw materials for a period of two years, the project to be administered by the Crop Protection Institute. It is expected that two or three research men will be located in existing laboratories, probably state experiment stations, under conditions which will permit of a thorough investigation of all the important factors, beginning with elemental sulphur and from this proceeding to compounds of sulphur.

This is a gratifying start toward solving problems of vital importance. May it prove to be only the beginning of a series of studies directed toward developing more efficient insecticides and fungicides.

E. P. FELT

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

FEBRUARY, 1922

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, provided that at least 100 reprints be ordered at full price rates; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

Separates or reprints, if ordered, when the manuscript is forwarded or the proof returned, will be supplied to authors at the rates given below. Note that the number of pages in a reprint may be affected somewhat by the make-up, and that part of a page is charged as a full page. Carriage charges extra in all cases. Shipment by parcel post, express or freight as directed.

One hundred separates or reprints at $4.00 per page or plate. A 50% reduction on the price of the first hundred reprints is allowed on each article ordered and paid for by members. Additional hundreds or less, 4 pages or less, $1.00; 5–8 pages, $1.50; 9–12 pages, $2.00; 13–16 pages, $2.50; 17–24 pages, $3.50; 25–32 pages, $4.50. Covers suitably printed on first page only, 100 copies, or less, $5.00; additional hundreds, or less, $2.00. Plates inserted, $2.00 per hundred, or less. Folio reprints, the uncut folded pages (50 only), sixteen page signature, or less, $3.00.

The Circulation Agent, C. W. Collins, has been appointed and has started operations. There is only one way to make good with Mr. Collins, and that is turn subscriptions in his direction. He is endeavoring to secure the coöperation of all for our mutual benefit. Have you "registered?"

The Toronto meeting must be regarded as an unusual occasion. It was an anniversary of our organization meeting. It was unique in there being sessions of the three national entomological societies of America, namely, the Entomological Society of Ontario, the Entomological Society of America and our own organization. These meetings brought together an unusually representative body of men—there were over 100 in the group photograph reproduced in this issue. It was particularly gratifying that such pioneers as Bethune, Forbes, Comstock, Howard and Osborn could be present. This gathering is not likely to be duplicated or eclipsed for many years. It was especially gratifying that such a very high proportion of the Canadian entomologists were in attendance. The dinners to entomologists were not only pleasant but extremely desirable features. We need to cultivate that feeling of good fellowship and solidarity, if we are to do our best. The prevailing sentiment is well expressed in the proceedings, reproduced on another page, at the general dinner.

The attention of all contributors is called to the marked changes in reprint prices, the arrangement concerning the early publication of papers and the elimination of an arbitrary limit in length in case at least 100 reprints are ordered at full price rates. In interpreting the action of the Association at the Toronto meeting concerning the publication of papers for which the author or institution with which he is

connected was willing to pay in case a number of reprints were supplied, it became necessary to change the rates for reprints. Heretofore they have been furnished at cost of printing and the JOURNAL has frequently met financial loss and there has been considerable difficulty in handling the business in connection therewith. In order to avoid the misunderstanding and confusion likely to result from the establishment of two rates, it has been decided to adopt a flat rate, with a reduction to members. It will be noted that 50 folio reprints may be obtained at a very low rate, but that the prices for all others are higher than heretofore. It is believed that most of the members who desire reprints for wider circulation than the JOURNAL affords will have little difficulty in securing them through the institutions with which they are connected.

Current Notes

Professor Herbert Osborn is spending the winter in Mississippi.

Mr. W. K. Makemson has been appointed extension entomologist and plant pathologist at the Florida University and Station.

According to *Experiment Station Record*, Professor G. M. Bentley, Associate Entomologist, was on July 1 transferred entirely to instruction work.

The annual address of the Entomological Society of America was delivered at Toronto, December 28, by Dr. Seymour Hadwen on "Northern Oestridae."

Mr. O. C. McBride has been appointed assistant in entomology at the Missouri Agricultural Experiment Station, in place of S. R. McLane, resigned.

Professor William Morton Wheeler of the Bussey Insitution, Harvard University, was elected president of the American Society of Naturalists at the Toronto meeting.

Mr. James Godkin has recently been added to the staff of the North East Laboratory, Bureau of Plant Industry, Pennsylvania Department of Agriculture.

Mr. F. H. Worsinger, Jr., is now locally in charge of the Japanese beetle work, Bureau of Plant Industry, Pennsylvania Department of Agriculture.

Mr. V. I. Safro, formerly of the Kentucky Tobacco Product Company, Louisville, Ky., is now Vice-President of the Nicotine Production Corporation of Clarksville, Tenn.

Professor C. R. Crosby, Extension Entomologist of Cornell University, addressed the annual meeting of the Connecticut Pomological Society at Hartford, on December 14, 1921.

According to *Experiment Station Record*, Mr. W. E. Jackson was appointed on September 15, Assistant Professor of Entomology at the Oklahoma College, vice Otis Wade, resigned.

Dr. W. C. Cook, formerly of the Minnesota Agricultural Experiment Station is to be connected with the Montana Agricultural Experiment Station in charge of cut worm investigations.

Professor G. H. Lamson of the Connecticut Agricultural College, Storrs, Conn., gave an address on January 6, before the New Hampshire Poultry Association at Concord, N. H.

A new laboratory has recently been built at Chambersburg, Pa., for the Bureau of Plant Industry of the Pennsylvania Department of Agriculture, and occupied September 1, 1921.

Mr. T. T. Haack, formerly of the Wisconsin Department of Agriculture is now in charge of the North East Laboratory, Bureau of Plant Industry, Pennsylvania Department of Agriculture.

Professor H. A. Gossard, entomologist of the Ohio Agricultural Experiment Station, recently spent a week of his vacation in Florida, where he was formerly entomologist of the Station.

Professor S. Mokrzicki, formerly entomologist of the Taurida Zemstvo in Simforopol, Russia, and more recently State Entomologist in Bulgaria, has been appointed Professor in the Agricultural High School, Warsaw, Poland.

At the entomologists dinner held at Prince George Hotel, Toronto, December 30, 117 were present. The speakers were Dr. L. O. Howard, Professor J. H. Comstock, Professor Herbert Osborn and Professor Lawson Caesar.

Mr. James B. Palmer has been appointed instructor in Extension Entomology in the New York State College of Agriculture, to succeed M. D. Leonard, who has taken a position with the Bowker Insecticide Company.

Dr. W. S. Regan, Assistant Professor of Entomology, Massachusetts Agricultural College, has accepted a position in the Department of Entomology, Montana State College, where he will devote half his time to teaching and half to fruit insect investigations.

According to *Science* Dr. E. D. Ball has been appointed by Secretary Wallace as the representative of the U. S. Department of Agriculture on the research information service of the National Research Council, to take the place of Dr. Carl L. Alsberg, resigned.

Dr. L. O. Howard gave the address of the retiring president of the American Association for the Advancement of Science on Tuesday evening, December 27, at the Toronto meeting. His subject was (a) "On Some Presidential Addresses:" (b) "The War Against the Insects," and was printed in *Science* for December 30, 1921.

On account of the severe illness of Professor Robert Newstead, the cooperative investigations on mite-infested wheat, carried on by the Liverpool School of Tropical Medicine, the Grain Research Laboratory, Winnipeg, and Mr. E. H. Strickland of the Stored Pests Investigations of the Entomological Branch, Canadian Department of Agriculture, have been temporarily discontinued.

Dr. L. O. Howard gave the first lecture in a course of popular scientific lectures before the Royal Canadian Institute at Toronto, October 29, 1921. His subject was "Some Aspects of Economic Entomology." It is expected that the other lectures in this course will be given during the winter by scientific men from the United States.

Science is authority for the announcement that a movement has been started to raise a fund of $2,000,000.00 to establish a medical school as a memorial to Major General William C. Gorgas. The present plan is that the fund be contributed by the nation and that the school be situated in Tuscaloosa, Ala., where General Gorgas lived as a boy. Dr. Seale Harris of Birmingham, Ala., is Chairman of the National Committee.

The following transfers in the U. S. Bureau of Entomology have been announced: J. D. Waugh, Mexican bean beetle control to plant quarantine inspector, Federal Horticultural Board; F. R. White, Mexican bean beetle investigations to sweet potato weevil investigations, at Gulfport, Miss.; John B. Gill, in charge of laboratory, pecan insect investigations, Brownwood, Texas, to Aberdeen, N. C., to investigate plum curculio and other peach insects; A. I. Fabis will have charge of laboratory at Brownwood, Texas.

The following resignations have been reported from the U.S. Bureau of Entomology; A. D. Borden in charge of laboratory, Alhambra, Calif., to accept a position as entomologist and manager of a local insecticide company. The laboratory has been closed. George H. Rea, Extension Specialist in Apiculture for New York, to accept similar position with the Pennsylvania Department of Agriculture; E. S. Prevost, to accept a state appointment wherein he will continue teaching and extension work in apiculture at Clemson College, S. C.

According to *Entomological News*, a zoological expedition to Brazil was organized at the Museum of Zoology, University of Michigan, through the interest and support of Mr. E. B. Williamson, Honorary Curator of Odonata. The members of the expedition are Mr. Jesse H. Williamson and Capt. John Strohm, U. S. A., who planned to leave New York on December 15, 1921 to be gone about eight months. Particular attention will be given to Odonata, but insects of all orders will be collected and much attention will be devoted to the spiders, shells, reptiles and amphibians.

According to *Science*, the Heckscher Research Foundation for the support of investigation at Cornell University has made grants for entomological work as follows:—to Professor J. C. Bradley, $700.00 (and $450.00 supplementary) to cover cost of preparing illustrations and completing manuscript embodying investigations of the wing venation of Hymenoptera; to Professor J. G. Needham and Dr. P. W. Claassen, $500.00 for preparing a monograph on the Plecoptera of North America; to Professor C. R. Crosby, $700.00 for drawings of the genitalia of a group of spiders, the Linyphiidae, to be used in devising a natural system of classification of the species and to determine the limits of the genera and their affinities.

Mr. E. S. Tucker of the U. S. Bureau of Entomology and recently engaged in the study of cotton insects, died at Tallulah, La., December 10, 1921, aged 54 years. Mr. Tucker received his scientific training at the University of Kansas under the tutelage of F. H. Snow, V. L. Kellogg and S. J. Hunter. At various times he served appointments under the University of Kansas, the Texas Agricultural Experiment Station, the Louisiana Agricultural Experiment Station and the United States Department of Agriculture. His entire writings comprise a list of 118 papers published in various places. He was a charter member of the Entomological Society of America, a member of the Kansas Academy of Science and of the American Association of Economic Entomologists.

The annual meeting of the Crop Protection Institute was held at the Seneca Hotel, Rochester, N. Y., January 12, 1922 at two P. M. Professor W. C. O'Kane was elected Chairman, Paul Moore, Secretary and G. R. Cushman, Treasurer, for the coming year. A dinner was held at the Chamber of Commerce at 6:30 P. M. in which scientists, manufacturers and fruit growers joined, 123 in number. The speakers were Mr. H. E. Howe, Professor W. C. O'Kane, Professor L. R. Jones, Dr. R. W. Thatcher, Mr. G. R. Cushman, Dr. A. L. Quaintance and Professor P. J. Parrott. Other entomologists present were: Dr. E. P. Felt, J. G. Sanders, Professor C. R. Crosby, M. D Leonard, Dr. W. E. Britton, G. E. Sanders, F. Z. Hartzell, Hugh Glasgow, Fred Johnson, B. D. Van Buren, J. T. Haack, J. F. Palmer and G. H. McLeod. Many of these men were in Rochester to attend the meeting of the New York State Fruit Growers Association held on January 11, 12 and 13. Mr. H. E. Hodgkiss was reported as being present on January 11.

At the Toronto meeting, the Entomological Society of America elected officers for 1922, as follows:—President, Arthur Gibson, Dominion Entomologist, Ottawa, Canada; First Vice-President, Dr. W. A. Riley, University of Minnesota, St. Paul, Minn; Second Vice-President, Professor R. A. Cooley, University of Montana, Bozeman, Mont.; Secretary-Treasurer, Dr. C. L. Metcalf, University of Illinois,

Urbana, Illinois; Additional Members of the Executive Committee, Dr. J. M. Aldrich, United States National Museum, Washington, D. C.; Mr. William T. Davis, New Brighton, N. Y; Dr. E. M. Walker, University of Toronto, Toronto, Ontario; Dr. O. A. Johannsen, Cornell University, Ithaca, N. Y.; Managing Editor of the *Annals*, Dr. Herbert Osborn, Ohio State University, Columbus, Ohio; Editorial Board, Dr. W. S. Marshall, University of Wisconsin, Madison, Wis.; Dr. Vernon L. Kellogg, National Research Council, Washington, D. C.; Dr. F. E. Lutz, American Museum of Natural History, New York; Dr. William M. Wheeler, Bussey Institution, Boston 30, Mass.; Dr. E. M. Walker, University of Toronto, Toronto, Ontario; Dr. S. A. Forbes, University of Illinois, Urbana, Ill.; Dr. A. D. Hopkins, Bureau of Entomology, Washington, D. C.; Prof. A. L. Lovett, Oregon Agricultural College, Corvallis, Ore.; Dr. Frederick C. Muir, H. S. P. A. Experiment Station, Hawaii; Assistant Managing Editor, Dr. C. H. Kennedy, Ohio State University, Columbus, Ohio.

Apiculture

Mr. G. B. Gooderham has been appointed Dominion Apiarist as successor to the late F. W. L. Sladen.

The meeting of the American Honey Producers' League was announced to be held at Salt Lake City, January 30 and 31.

The North Carolina State Beekeepers' Association planned to hold its winter meeting at the State College, Raleigh, January 18 and 19.

Mr. O. A. Sippel formerly of the apiary division of the Ontario Agricultural College, has recently accepted an appointment as instructor in beekeeping at the Montana State College.

The meeting of the Oregon State Beekeepers' Association is scheduled to be held at Pendleton, Ore., January 26-27, 1922. Mr. H. A. Scullen, Corvallis, is the Secretary.

The annual meeting of the Pennsylvania State Beekeepers' Association has been arranged for January 24 and 25. at the time of the Pennsylvania State Farm Products Show at Harrisburg.

The meeting of the South Dakota State Beekeepers' Association was held at Mitchell, S. D., February 13-14, 1922. Mr. J. C. Tjaden, Vermillion, S. D., is the Secretary.

Mr. A. E. Lundie, an entomologist from South Africa, is visiting the United States, and is at present taking some research work at the Bee-Culture laboratory, U. S. Bureau of Entomology, to supplement the work in beekeeping which he is carrying on at Cornell University.

A fund is being collected from the beekeeping friends of the late Doctor C. C. Miller, the income from which will be used to establish a permanent library of apiculture, to be placed in the care of one of our leading educational institutions. Contributions of books and journals from individuals are welcome, as well as contributions of money from both individuals and associations. The committee in charge of the matter consists of C. P. Dadant, Hamilton, Ill., E. R. Root, Medina, Ohio, E. F. Phillips, Washington, D. C., E. G. LeStourgeon, San Antonio, Texas, and B. F. Kindig, East Lansing, Mich.

Department of Horticultural Inspection

Nests containing from three to six living larvae of the White Tree Pierid, *Aporia crataegi* L., were intercepted by Federal Inspector Joby A. McCutchin in shipments of fruit and rose stocks arriving at New York from Angers, France. Literature fails to record this insect as being established in the United States; and, to prevent the introduction of this pest, the Chairman of the Federal Horticultural Board has advised the Government Entomologist of France that plant material forwarded under French certificate must be free from the nests of this insect, as well as other pests.

The White Tree Pierid is reported to be a general feeder in Europe, injuring the foliage of fruit and wild rosaceous plants, as well as shade trees, including oak, mountain ash, willow, etc. It has from time to time been reported as occuring in Russia, Roumania, Sweden, Germany, England, Spain, France, etc. Records of the Federal Horticultural Board indicate that some sixty-two nests of this insect were intercepted on fruit and rose stocks arriving from France in 1921. The nest of White Tree Pierid is suspended from the infested twig by a silken thread, and this characteristic, as well as its size, will readily distinguish it from the nest of the Brown Tail Moth (see plate 3).

The Sorrel Cutworm, *Acronycta rumicis* L., was collected by H. J. Speaker, Ohio State Inspector, January 11, 1922, on Manetti rose stocks arriving from Angers, France. This cutworm has been intercepted on several occasions in years past, and an effort should be made by all inspectors to prevent its entry and establishment in the United States.

Manetti rose stocks from England and Holland have been found to be infested with *Emphytus cinctus* L. by Herbert F. Seifert of Illinois, and the same insect has also been taken by Q. S. Lowry of Massachusetts on stock arriving from France.

Sweet potatoes from Haiti in ship's stores of a vessel arriving at Philadelphia, were upon inspection, found to be infested with *Cylas formicarius* Fab. by Federal Inspector C. A. Davis. These tubers from Barbados were also found infested with *Euscepes batatae* Waterhouse in a vessel arriving at New York by Federal Inspector E. Kostal.

It is reported that a shipment of potatoes from Blackfoot, Idaho, which arrived at San Diego, California, was found upon inspection by a Plant Quarantine Inspector of the California Department of Arriculture to contain the Alfalfa Weevil. This was also found in alfalfa hay used for food in two cars containing race horses which were being shipped to Tia Juana.

In order to prevent the entry and establishment of the Mexican Cotton Boll Weevil in the state of Arizona, the Arizona Commission of Agriculture has authorized the placing of inspectors on the highways entering that state. The timeliness of this action was soon evident, since the Mexican Boll Weevil was found in a small collection of short staple cotton seed which was taken from an auto tourist shortly after the inspectors were placed on the roads.

On account of the possibility of introducing into the mainland subterranean or soil infesting insects, the Federal Horticultural Board has announced a public hearing to be held in Washington, March 7, for the purpose of considering the advisability of prohibiting the entry of sand, soil, or earth from the territories of Porto Rico and Hawaii.

Plants for distribution at the Plant Introduction Gardens of the Department of Agriculture located at Savannah, Georgia, Brooksville, and Miami, Florida, were inspected by Messrs. H. L. Sanford and J. A. Stevenson; those at Chico, California were inspected by Messrs. W. S. Fields and T. D. Urbahns; and those at Bellingham Washington, by Mr. A. G. Webb.

The fourteen-car fumigation house at Nogales, Arizona, which was erected by the Federal Horticultural Board, was completed early in the Fall and put into operation on December 1. At the present time, there are four Federal inspectors located at Nogales. The work at the port is in close cooperation with the Customs and Immigration Services, as well as the State Entomologist in Arizona. There were 19,977 cars fumigated on the Mexican Border from July 1 to December 31, 1921 inclusive, in contrast with 15,490 fumigated during the preceding fiscal year.

Professor Davis Lumsden, formerly professor of floriculture at the New Hampshire Agricultural College, and subsequently assistant professor of floriculture at Cornell University, has been appointed as horticulturist for the Federal Horticultural Board, and assigned to the Foreign Plant Quarantine Service.

Left: Nests of Brown-tail Moth Collected in New England.

Right: Six nests of the White Tree Pierid on Stock Arriving from France, Illustrating Method of Suspension. (Natural Size.)